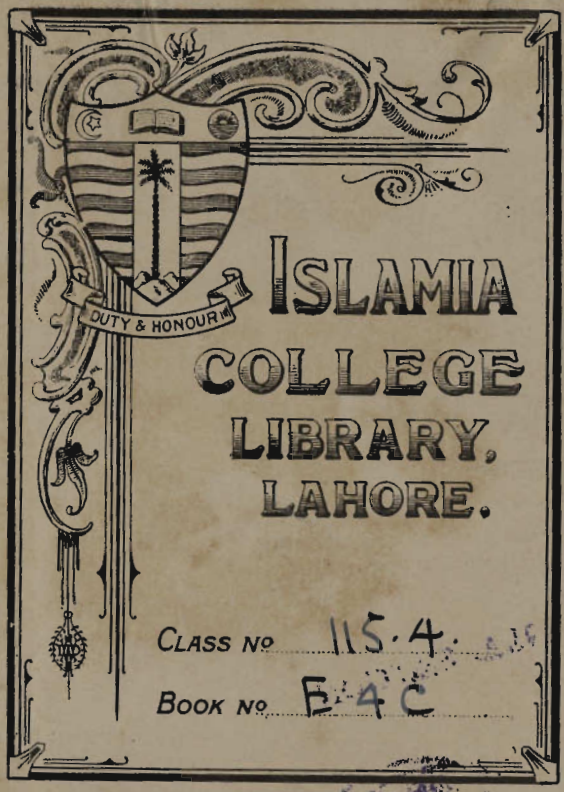

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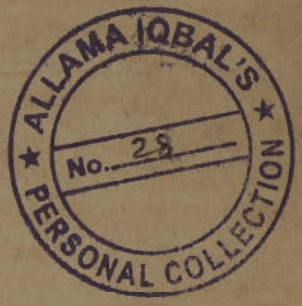

CONSCIOUSNESS, LIFE AND THE FOURTH DIMENSION

CONSCIOUSNESS, LIFE AND THE FOURTH DIMENSION

A STUDY IN NATURAL PHILOSOPHY

BY

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GYLDENDAL

11 HANOVER SQUARE, LONDON, W.1

1923

COPENHAGEN CHRISTIANIA

Printed in Great Britain by Hazell, Watson & Viney, Ld.,
London and Aylesbury.

IN GRATITUDE

DEDICATED TO

PROFESSOR DR. KRISTIAN KROMAN,

COPENHAGEN

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INTRODUCTION

SOME LEADING IDEAS OF THE TREATISE

As is well known, the theory of relativity has its " absolute world " beside the relative one. It is a " world " in relation to which space and time in conformity with the colours—or sense-qualities in general—are phenomenal appearances dependent upon the observer and his standpoint within the " world." As science found behind the world of colour and sound, etc., a world of motion (or vibrations), in which space and time reigned supreme, so we are now referred to a four-dimensional world, in which space and time in their turn are reduced to perspective " shadows " and the " law "—or mathematical formula of Minkowski—has the supreme power.

The interest of philosophers will naturally be especially attracted by this new " absolute world." But in accordance with different epistemological points of view it will be interpreted differently. To the positivist this " world " can no more be absolute than any other concept by which we transcend the phenomena of sense. Only the sense-phenomena as they are immediately given can have reality for the positivist. The presentations and concepts, by which we go beyond them, are only supplementary constructions, which cannot reveal any objective reality, but nevertheless are valuable as a means to simplify the world-view. The justification of such presentations and concepts to the positivist will therefore only be subjective and relative. The more

expedient formula must be preferred to the less expedient. Thus the " world " of Minkowski can no more be absolute than space and time. It is only the most expedient formula by which the subject can adapt itself to the phenomena of experience. The theory of relativity makes a halt before the " law," which is excepted from the maelstrom of relativity and made independent of the observer and his standpoint. Here the positivists cannot follow the relativists of modern physics, because they cannot give the law any exceptional place among the constructions of expediency.

The a-priorist philosopher cannot find a place for the theory of relativity within his world-view without making fundamental changes in it. Therefore the strongest opposition to this new departure in physics has come from a-priorist quarters. The " absolute world," or rather the realm of absolute necessity and validity, has, according to this philosophy, its source in man or rather in his *a priori* contributions to sensuous experience and scientific knowledge. Among these contributions space and time play a prominent part as the source of the synthetic a-priority of geometry, kinematics and mechanics. And the only space (and time) which this philosophy will admit is that in which the sense-intuition of man seems realised, e.g. euclidic space, while the theory of relativity demands, on behalf of physical reality, room for other spaces, especially that of Riemann. Thus a-priorism can only adapt itself to the theory of relativity by sacrificing the *a priori* necessity of euclidic space, as is done, for instance, by Cassirer, who in place of euclidic space-intuition adopts a " universal law of juxtaposition," by which euclidic geometry is placed side by side with the so-called metageometries.

But the consequence of this compromise is that *a priori* necessity is banished from the field of sensuous

experience and confined to the field of unsensuous, intellectual operations. Thus the *a priori* position as such is essentially weakened, because a much wider field is allowed to the accidentalness and free variability of sensuous experience, which for this reason rightly may demand a much more independent and strong position in relation to the *a priori* source of knowledge.

In empiric realism the field allowed to sensuous experience is of course much wider than in a-priorism. But by its realistic point of view it is led much more deeply into metaphysical regions than positivism and a-priorism. To empiric realism the presentations and concepts by which we go beyond the immediately given phenomena of sense have objective meaning and validity. They are not reduced to subjective expedients as in positivism or interpreted in the terms of " a transcendental method " as in a-priorism. Consequently they must be regarded as correlated to a reality the nature of which in a greater or less degree is revealed by them.

From this point of view such a concept as the " four-dimensional world or continuum " of Minkowski must necessarily give rise to many important questions, which the positivist will evade by his principle of expediency and the transcendentalist by reference to the inherent limits of human cognition. What is the nature of that reality in which space and time coincide or in relation to which space as such and time as such are perspective abstractions ? Is it material, spiritual or both at the same time ? Is it possible to form a qualitative and consequently *intuitive* idea of such a reality apart from the mathematical and therefore necessarily abstract intellectual formula ?

It is very often forgotten that validity and reality are correlative terms. Validity ceases to be valid if there is no reality to which it rightly may be applied. And

reality can only be real to a mind which is able to form valid ideas or concepts about it by means of a mental activity, which in itself is free to deviate from reality and form invalid ideas as well as valid ones. The mathematical formula of Minkowski is not reality *itself*. It can only be a pointer in the direction where it is to be found.

In the following pages I have tried to show that a reality which at least in some measure has the qualities of four-dimensionality is not altogether unknown to us. It will be remembered that the most prominent feature of this four-dimensional continuum is the simultaneous presence of events which from the ordinary point of view succeed each other. The motion of a point through three-dimensional space is in the " absolute world " of Minkowski represented by a " world-line," because the succession of moments, in which the point is present in the different points of space in the " absolute world," is simultaneous as a co-ordination. If we look for such a characteristic within reality we are led on the one hand to organic life, by which a succession of phases in the life of organisms is related to an enduring organic type, and on the other hand to consciousness, by which a succession of experiences and ideas is related to and surveyed by an enduring subject. We might characterise the organic type as a four-dimensional simultaneous presence in the succession of organic processes and movements, and the subject or ego as a similar four-dimensional presence in the succession of experiences and ideas.

And a peculiar interdependence is seen to connect life and consciousness. The predominance of life is generally connected with a lowering of consciousness and the predominance of the latter with a weakening of life. It is as if life were a means to throw outwards into

spatial existence as dynamical physical realities the typical and general ideas, which by consciousness are thrown inwards to the subjective *power of awareness* and thereby revealed as a-dynamic incausal *forms* devoid of physical efficiency. By consciousness then we may discern as a sort of reflected images the ideas or " four-dimensional presences " underlying the motions and successions in physical reality, whether organic or inorganic. But as images reflected in a mirror may be considered as a-dynamic in relation to the physical bodies mirrored, so ideas—when perceived by consciousness—are stripped of all dynamic relations to physical reality. It is as though they are made dynamically or physically impotent by the very process by which consciousness or the subject *becomes aware* of them.*

* In the theory of relativity the velocity of a motion in *space* is completely determined by the direction of the world-line in *space-time*. Thus motions in space present themselves in space-time as " traces." Motion may be called displacement along these traces, though this displacement may be reduced to zero without altering anything in the motion. Now this conception of motion as displacement along the traces naturally leads to a consideration of the traces themselves, and as space-time in the theory of relativity is the only reality, we are referred to the traces as something real. And if we consider the moment " now " as it is experienced by our psyche from moment to moment in real life, it must be admitted that it essentially has the character of a trace, i.e. we comprise in this now a series of points, the displacement being a secondary process. In a similar way the enduring organic types may also be pictured as traces.

It will be understood that this distinction between the traces and the displacement along them is intimately connected with the idea of causality, especially in the physical sense of the word. The causal relation is conditioned by the displacement along the traces in space-time. In so far, then, as a displacement is out of the question and we have to do with the traces themselves, the application of the concept of physical causality has no meaning. Thus we are obliged to consider the traces either as a-dynamic or as dynamic in another sense than the dynamics of physical causality. Both these alternatives are here worked out, the first in the case of consciousness, the second in the case of life.

So the ideas of consciousness may be considered as incausal and a-dynamic in relation to physical reality while the ideas of (unconscious) life may be considered as dynamically immanent in physical processes. It will easily be understood that this a-dynamic character of the ideas as formal or abstract objects of consciousness is a condition of the *freedom* of conscious insight and activity. If consciousness were dynamically or causally *compelled* by its contents (or ideas), in the same manner as a billiard-ball, which is set in motion by a cue, it could not gain the independent attitude towards them which is necessary for the free realisation of mathematical and rational necessity, which is fundamentally different from causal necessity. On the other hand, it must be remembered that the ideas, by being lifted out of all physical dynamics, are related to a deeper dynamics in *feeling and will*, e.g. the creative potencies in man which just by reason of the a-dynamic character of conscious ideas are placed in a free relation to reality, otherwise impossible.

Our concepts and general ideas, whether they be found dynamically present and defined in physical reality or be realised in consciousness as a-dynamic, abstract objects, may thus be looked upon as a medium of a " four-dimensional " point of view, because they enable us to survey simultaneously what as sensuous and physical beings we must experience successively. In reality we are as *thinking* subjects living in " the absolute world " of Minkowski in so far as we are able in our memory, our plans, and especially in our thoughts to survey the time and space, which to the sensuous and physical subjects can only be present successively and separately. As thinking beings we are emancipating ourselves from the perspectivity involved in our sensuous and physical existence, because by thinking

we neutralise the distortions and supplement the shortcomings in the world-view, which is the result of the "standpoint" we occupy in the universe, i.e. the place which we occupy in sensuous space and the state of motion in which we participate as belonging to the earth and the solar system. As *physical* beings we fill with our bodies a subjective central space *within* the space of the senses as well as the space of physics. As *thinking* beings we are able to neutralise the subjectivity of our bodily space and look upon it as a continuous part of the whole physical space. And by the same power of thought we are also able to neutralise the perspectivity of space and time which may be the result of our participation in a definite physical state of motion in relation to other motions.

But if the ideas which by consciousness are realised abstractly and a-dynamically may be considered as present in physical reality in a dynamically *defined* form, we are led to ask for the nature of the dynamics connecting spiritual ideas with physical reality. It will easily be understood that in these dynamics we have to do with a deeper power in the universe than in the mechanical or energetic dynamics of ordinary physics. It must be a dynamics more akin to organic growth than to mechanical motion or energetic "work," and therefore not manifesting itself in the collateral outer relation of isolated particles in space and their mutual displacements by motion, but rather in the *ordering* of motions to *forms*, filling not only their *own* space, but also their *own* time, and therefore representing an organic union of a specialised space with a specialised time, a "time-space." By the very fact of this union of space and time in an organised *whole* the organic dynamics may be called four-dimensional and be connected with the simultaneously surveyable presences of concepts and ideas.

The organic point of view may be applied as universally to physical reality as the mechanical or energetic point of view. A " world-organics " is as justifiable as a " world-mechanics." Till now the mechanical point of view has been the dominating one in physics, and it has been very fruitful for the understanding and mastery not only of inorganic, but also of organic nature, though its special field must always be the inorganic world. We need not here dwell upon the shortcomings of this point of view. They are especially prominent when we consider the morphological problem of organic nature and the potentialisations of energy represented by the different elements, masses, or even molecules and atoms in inorganic nature. Here we will only emphasise, that as the mechanical point of view may be applied with profit to the organic domain, because organisms have their mechanical side, so the organic point of view may profitably be applied to the inorganic domain, because the latter has its organic side in addition to the mechanical. If the essential points in organic dynamics are realised, it will be seen to supplement rather than to contradict mechanical and energetic dynamics, showing us from the inner side of continuity what in mechanical and energetic dynamics is presented from the outer side of discontinuity.

In the following pages some new concepts are developed which I hope may contribute to make the idea of such an organic dynamics acceptable. As the four-dimensional view involves a higher *simultaneous* presence in that which by motion and from the outside is presented as *successive* in different points of space, it leads to a dynamic concept antithetically related to that of physical motion, i.e. to a dynamic *rest* IN *motion*. This rest in motion is intimately related to form and life, and its realisation in physical nature appears in the

rhythmisation of subordinate motions by which parts of particles appropriated by the sphere of dynamic rest are kept in ordered motions or rather made to *repeat* definite motions—especially curved ones—in definite intervals of time. Such a rest in motion will perhaps best be understood if we remember the way in which our own organism is present to our " inner sense." Our consciousness is connected with our physical organism by a " feeling of life " half conscious, half unconscious or subconscious, by which we feel ourselves simultaneously present in every point or part of the organism and experience it as a continuous unity. By this feeling of life we realise a sort of resting but dynamic immanence in all the motions going on within the limits of our own organism, among which the rhythmic motions represented by the pulsations of the blood and the respiration of the lungs play a very prominent part. We may also use the sense-qualities as illustrations of this rest in motion because they present to consciousness as a continuous simultaneously surveyable whole what from the physical point of view is represented by rhythmic vibrations. Indeed, the transition from the physical to the psychical may be considered as a transition from motion to rest (i.e. the rest of sense-qualities, presentations and concepts, which of course do not move in physical space), implying on the side of the " psyche " an *inversion* of that relation to space which physical bodies realise by their *motion* in it.

Thus we may represent the dynamic rest in motion as a *negative* filling of space in opposition to the positive filling of it, represented by the moving bodies. And we may in this negative, simultaneously present relation to space find the truth underlying the idea of " action in distance " as opposed to action by contiguity. In the domain of inorganic nature we are led by the develop-

ment of this idea to a definite distinction between the idea of energy and the idea of force, the latter especially appearing in the potentialisations in masses, elements and forms of that energy, which is made kinetic by liberating dissolution. When the implications of the entropy and radioactivity are realised it will be evident that the concept of energy can only represent a disintegrative analytical tendency which must be supplemented by the integrative and synthetic tendency of force, if the new formations of material systems are to be explained.

It will be understood that the realisation of the organic point of view involves a dynamics of continuities, not of discontinuities. There is, however, in science a tendency to evade the conception of dynamic continuities by substituting for it the conception of " empty space." But empty space is physically an unjustifiable conception, because the dynamic point of view is inseparable from physics. The meaning of an absolutely empty space can only be that space is considered from an *a-dynamic* point of view, e.g. as an abstract ideal or idea of consciousness. A space, i.e. a continuity which is absolutely empty in the sense that no dynamic influence whatever is exerted by it upon the bodies moving within it, is surely impossible as a physical reality. *Physical* space must therefore have the character of a dynamic continuity—or it does not exist at all. The illusion of an empty space as a physical reality is the result of a natural tendency to confound the space of geometry and the space of physics. Geometry has nothing to do with physical space. The only object of its investigations is the formal or intuitive space which as an idea of consciousness is realised from a purely a-dynamic point of view. But as we use ideal space as a means of orientation in the physical space, which we learn to

know by sensuous experience, it is very easy to confound the two and to transfer the a-dynamic point of view belonging to geometry and formal science to physical or dynamic nature. The picture of nature as consisting of an illimitable number of non-extensive mass-points separated from each other by an intermediate empty space is a geometric, not a physical conception. In geometry the space separating the points from each other may be called empty, because it is a presupposition that the geometric space as such does not exert any causal or dynamic influence upon the ideal figures constructed in it by mathematical imagination. Or, rather, the alternative, " filled or empty," is inapplicable to geometric space. But physical space can only exist by being filled, i.e. by being pervaded through and through by an organic " simultaneous presence."

Of course the dynamic continuity representing the inner coherence of the whole universe may very largely be treated *as if* it were an empty space, as up to a certain point we may regard the air as representative of such an empty " nothing." But just as we very quickly reach the point where the dynamic influence of the air appears, so we may sooner or later reach a point in our physical investigations where dynamic effects of a cosmic continuity may come to light. It may be that the Michelson-Morley experiment is such a point. The " contraction " of Lorentz, i.e. the idea that all bodies are shortened in the direction of their motion, is from this point of view no impossibility, considered as a result of an interplay between the electrons and the dynamic continuity within which they move. Here it must be remembered that a dynamic continuity is something altogether different from an a-dynamic logical or mathematical continuity such as an arithmetical progression.

However this may be, it must be kept in mind that

when moving bodies are related to an absolute or empty space, they are related to an abstract a-dynamic idea of consciousness, not to a physical reality. Of course this does not mean that the idea of space is of no value to the investigations of physical nature. Without abstract ideas no knowledge of physical reality is obtainable. But we must beware of transferring to physical reality qualities which only can belong to the ideas in their a-dynamic *abstractions*. So it is only in the ideal space of geometry that a point can move *ad infinitum* without changing its direction in relation to the surrounding space. The infinite straight line can be no physical reality, because the dynamic continuity within which a body is moving in physical space in the long run must cause a change of direction. The dynamic continuity of the universe is in all probability a curvative one and in so far in accordance with Riemann's geometry, resulting or appearing in a return to the point of departure.

The idea of empty space is an abstraction serving materialism by surrounding the material universe with emptiness and nothingness on all sides. But the conception of the universe as a dynamic continuity opens a way to connect the physical universe with an inner cosmic life and spirituality.

This treatise is not originally meant or planned as an investigation into the theory of relativity. But the development of its leading ideas made it necessary to deal with the problems involved in this theory much more thoroughly than was intended at the outset.

CONSCIOUSNESS, LIFE AND THE FOURTH DIMENSION

CHAPTER I

SUBJECT AND OBJECT

THE modern theory of relativity has made the question of higher dimensions of reality an object of renewed interest. Time is considered as the fourth dimension of space and enters into the fundamental equations of relativity just as do the co-ordinates of space. Thus a four-dimensional mathematical scheme is applied to the world of physics. But the problems connected with space and time, the relations between them and the part they play in reality as a whole, cannot be treated by mathematics and physics alone. Here psychology and epistemology must have a word to say as well, because space and time are factors with which in various forms they have to deal.

To understand the special part played by space and time in the physical world we must for the sake of comparison have some idea of the part they play in the world considered as subjective: the world of psychic processes and thought. The problem of space and time is thus connected with consciousness or the relation between object and subject, and it will be useful to begin our investigations with an analysis of this relation.

SELF-FEELING

If it be asked, in what form the self most immediately is present to consciousness, we must answer: as a feeling. This self-feeling has been characterised in various ways:

as a central feeling or an unreflected, immediate feeling of being and life. As the subjective or inner side of psychic life it is in itself insusceptible of real, presentative objectivation. We should be unable to form a presentation of it at all, save for the fact that it is intimately connected with the objective or outer sensations we have of our own body as different from surrounding bodies.

The *presentation* of self, founded on the immediate self-feeling, is as such only a presentation on a level with other presentations in our consciousness. But we must remember that this presentation is not myself, but only "my" presentation of myself, through this "my" pointing back to the *felt* self as something over and against the mere presentation of it. Therefore the presentative side of consciousness can never grasp the self, the presentation of self being only able to exist as a presentation among other presentations, which the real self "has." But this pointing back to the real self shows that the self has some other unpresentative or unobjectifiable way of being aware of itself different from presentative consciousness, namely, feeling.

This self-feeling is, however, as suggested above, closely connected with the body, which among the presentative objects of the outer sense forms an exception by being animated and felt from within as well as seen from without. If our body were only an object of the outer sense, there would be no difference between it and the objects we see around us. The only difference would be, that it would always be present to sight and touch, though head and back of course would be invisible. As a presentative object our body has its unique position in virtue of the self-feeling, by which it is animated from within.

Closely connected with this self-feeling are, of course, those organic sensations which when perceived are

localised on or inside the body : sensations of temperature, muscles, respiration, blood-pressure, digestion, etc. They form a complex, very difficult to disentangle, coalescing with the more amorphous feelings and their constant background : the self-feeling, from which they emerge.

Common to all those parts of psychic life which are closely connected with self-feeling, is that they in a greater or less degree resist objectivation, and that they need the orientation of the outer senses or correlation with organic movements and with presentations originated from without to become definite presentations in psychic life. As the self-feeling may be said to be objectified in our body as an object of outer sense, so the more or less amorphous feelings may be said to objectify themselves by becoming associated with organic processes, mimic movements and with presentations derived from the outer senses.

Self-feeling and the elements of psychic life connected with it may thus be said to undergo a transformation from within outwards to become part of consciousness. On the other hand a transformation in the opposite direction—from without inwards to the feelings and self-feeling—may be said to take place with the elements of psychic life originating in the outer senses, especially sight, but also hearing and touch. These objective sensations are subjectified by correlating and associating themselves with organic sensations, feelings and in the last resort self-feeling, thus becoming reproducible elements of psychic life. The most objective perceptions (or sensations), the contents of which seem to have an existence quite independent of myself, are nevertheless in some way or other " my " perceptions, which shows their connection with self-feeling and points to the processes by which their contents are subjectified. But

apart from this they are to a large extent parts of an outer world which is common to the various subjects, thus differentiating themselves from the subjective psychic life, which is different for every individual.

Though separate for every individual the subjective psychic life can obviously only be perceived as such by being set up against and distinguished from a surrounding world common to all subjects and accessible to cognitive consciousness. By denying this surrounding world as common to the various subjects, the subject may therefore be said in a certain sense to deny itself. The basis for this community of surroundings is of course space, which at the same time is the extreme verge of presentative consciousness, being the very principle of *objectivity*, while self-feeling is the principle of subjectivity, representing the extreme point to which consciousness can withdraw itself without objectifying its subjective experience to separate and reproducible elements of psychic life.

Subjectivation and Objectivation

So psychic life may be said to oscillate between two extremes; the outer surroundings in space as the objective extreme and principle of the presentative side of consciousness—forming the starting-point for a process of subjectivation—and self-feeling as the subjective extreme, being the starting-point for a process of objectivation. And it is important expressly to note, that these two extremes must be placed outside the confines of the psychic life in so far as this is understood to consist of conscious processes, embraced by memory. The self as such and the outer sense as such cannot enter into memory. To do this they must undergo a sort of transformation, which, as we have seen, to the outer sensations implies a process of subjectivation and to the self

(with its feelings and impulses) a process of objectivation. By subjectivation the outer sensations are made presentations, while the self only can be made a presentation by objectivation. But both processes have the feature in common, that they link together elements of an objective presentative character and elements of a subjective character and origin.

Sense-perceptions can only be repeated by restoring all the conditions under which they arose, and as these conditions only partly are subjective or dependent on the will of the perceiver, the sense-perceptions as such cannot be said to enter memory, which only includes presentations and elements, to the reproduction of which subjective conditions are sufficient. And this insusceptibility of reproduction is also a characteristic of the self. What can be remembered or reproduced is only the self as qualified by a certain experience, feeling or activity, different from others, not the self as such. The self can only enter the sphere of reproduction by its connection with elements, which can be singled out and objectified as something distinguishable from itself.

The sphere of reproduction is thus seen to mediate between two extremes, the one subjective and the other objective, the one represented by the self, the other by outer space. But within these two extremes the dividing-line between subject and object can be shifted at will, because the various psychic elements or groups of elements, which are subject to memory, can be placed now on the objective and now on the subjective side. Elements, which in one moment are singled out and made an object of conscious awareness and scrutiny are in another moment to be found on the side of the subject, focussing its attention on other elements. Thus we find within conscious psychic life no hard and fast line between subject and object, but only a sort of

movement to and from a foreground (object) and a background (subject), by which on the one hand elements belonging to the background are placed in the foreground, while on the other hand elements belonging to the foreground are attached to the background. The subject or background is therefore practically never a *pure* subject, but a subject identifying itself with various presentations, feelings or intentions in relation to the foreground, i.e. the object or objects present to it.

When the attention is concentrated on the foreground or object, the reproducible elements belonging to the subject in the moment of concentration are not attended to and therefore form a vague undifferentiated mass. The subject and the elements with which it is identified are therefore always the relatively unconscious side of psychic life compared with the object, illuminated by consciousness. And it may perhaps also be said that the process by which presentations are detached from the subject and placed in the foreground as object is at the same time a process by which these presentations emerge from a sort of germ-state, in which they remain when attached to the subject, and develop into a more or less definite state, characteristic of the object.

Practically the body is always reckoned to the subject, while its surroundings are placed on the objective side. But in a metaphorical sense the subject may identify itself with its belongings, its family, home, country, etc., apprehending all this as a total subject in relation to the rest of the world as object. On the other hand, when the psychic life is discriminating itself as subjective from the objective world, common to the various subjects, it detaches the body from itself and looks upon it as an object of the outer world—a process which is repeated within the subjective sphere whenever an element or a

group of elements is singled out and placed in the foreground as an object of attention.

So the dividing line between subject and object may be drawn very differently. By psychological or philosophical analysis we can peel off from the subject the body and all the reproducible elements and then find ourselves standing before the pure subject, which apparently never can be made object. But the only thing made evident by such analysis is, that the pure subject as distinct from all the reproducible elements is the inner boundary-line of conscious psychic life, as the objective sense-perceptions form the outer boundary-line. But this inner boundary-line cannot be considered as absolute and fixed. It is movable and it is constantly pushed further back or inwards, whenever by a finer discrimination and self-observation aspects of subjective life, which without this discrimination would remain subconscious and unobserved, are taken in by consciousness and detached from the pure subject as new reproducible elements of psychic life.

As the field of outer observation can be widened by movements or travels, so the field of inner observations can be widened by developing the discriminative powers in this direction. The pure subject, veiling unobjectified and therefore unconscious aspects of subjective life, may therefore in one man have a much larger extent than in another.

The Outer and the Inner Sense

From the foregoing it will be evident that the sphere of sense is larger than the sphere of reproduction. It includes on the one extreme the world of space, represented by outer sensations, and on the other extreme the self-feeling as the ever-present background, from which the foreground is illuminated, while the sphere of

reproduction, which itself may be regarded as part of the sphere of sense, forms an intermediary between the two extremes, more or less extensive according as more or less psychic elements become distinguishable and reproducible.

Thus the self may be said in the first instance to form an object of sense, but of course of the inner sense. And the same may be said about the various elements of the reproducible sphere, in so far as they are considered only as objects of passive awareness. But as objects of reproduction they also enter into a peculiar relation with the activity of the self—which we shall deal with later on—going beyond that of passive awareness or the sense-relation.

But in the present connection it is important to note that there is a real difference between the outer and the inner sense, making it impossible to reduce the one to the other. This difference does not include a difference of kind between the various reproducible elements presenting themselves to the outer and the inner sense respectively. It is rather a difference in the *direction* of awareness (or perception). Psychic elements perceived by the inner sense as belonging to the self—ideas, feelings and emotions—may be immediately present to the outer sense as well, e.g. when I am conversing with a fellow-man, taking in not only his mimics and words by sight and hearing, but also as part and parcel of that which I see and hear, his ideas and feelings. On the other hand the objects of outer sense are—though of course transformed into presentations—objects of the inner sense in the case of association and memory. But I am obviously directing my power of being aware in opposite directions, when I perceive the surrounding world and when I perceive myself as in some way acting in it. The contents of the reproducible sphere may thus be

discerned in both directions. But this is not the case with the self as such or the material bodies in space—the two extremes, by which the power of being aware in both directions gains a foothold in reality.

Considered in relation to consciousness, sense—the inner as well as the outer—may be characterised as a form of passive, not active awareness. Obviously sense implies consciousness, as no sensation can exist without having in some way a conscious existence. Now consciousness always implies a duality: the being aware of something and the something (object or contents) of which one is aware. Though the word consciousness accentuates the subjective side of the duality—the being aware—and therefore is more fit to designate the higher psychic life than sense, where the objective side—or that, of which one is aware—seems to hold the ground alone, it cannot be opposed to sense, because sense would be impossible unless the subjective side—or the being aware—were present as well, though unnoticed in the act by which the object of sense reveals itself.

By sense, then, we must understand a form of consciousness in which the subjective side is reduced to a state of passive awareness because it is more or less perfectly dominated by the object, with the result that the subject is thrown out of the field. Now it might seem that from this point of view there would be no reason to speak of an inner sense, because this effacing of the subject by the object is only characteristic of the outer senses. But it is undeniable that this passive awareness can be turned inwards to the ego as well as outwards to the thing, and that in both cases we are aware of a *reality*.

When we are aware of ourselves as writing, thinking, loving, expecting or wishing something, we are aware of the ego as a reality behind the subjective activity or

feeling, with the same immediacy as when we are aware of the reality of a chair or a table, presented to us by the outer sense. The reduction of the thing or the ego thus discerned to a complex of psychic elements differently interrelated, is the result of a process of abstraction, excluding from the object all that is not characterised by clear presentativeness or phenomenality. And as that which gives reality to the thing as well as the ego is of an unphenomenal, unpresentative character, we are removed by this abstract phenomenalisation of experience from the real world in which we move and have our being, to a phantom-world, where there is no real object and no real subject. And every attempt to reconstruct reality by means of the phenomenal elements, thus distilled out of real experience, must be a failure, because the mere *idea* of reality or the reality as a phenomenal element only ("belief" or whatever one may call it) detached from the living coherence of actual experience and put into a complex of elements as an element on a level with the others, is unable to make up for the reality as immediately apprehended in experience, but expelled from it by the process of abstraction and phenomenalisation. This falsification of experience by the very philosophy which professes to follow it is one of many proofs that the pitfalls of abstraction are not to be found on the side of the rationalists only.

The reality may even be said to be experienced more immediately in the subjective direction or by the inner sense than by the outer senses, because every idea or feeling must be apprehended by the inner sense as "my" idea or feeling or as something inseparable from the ego. All phenomenal elements of psychic life are thus immediately connected with the subjective reality transcending them by its very insusceptibility to objectivation in presentation and thought. On the subjective side the

ego is therefore always present as an unobjectifiable "more" of reality, beyond the various reproducible elements or the sum of them. And the unpresentative or unphenomenal character of this reality makes it only more real to an apprehension which is not entangled in the illusive prejudice that all which is felt in an unpresentative manner necessarily must be unreal and non-existing.

Thus it may be said that the ego as an object of the inner sense compared with the thing as an object of the outer does not lose, but rather gains in reality by its deficiency in the clearness, which is so characteristic of the thing. And it must be remembered that the thing, notwithstanding its sensual clearness, contains no less than the ego a "more" of reality in addition to its phenomenality, though this "more" here has the character of a passive mass or inertia forming an antithesis to the source of activity which we call the ego. Thus the presentative thing and the unpresentative ego may be compared with the two foci of an ellipse, around which the reproducible elements of the intermediate sphere gather themselves as molecules around the nucleus in crystallisation. All these reproducible elements are —though in different degree for the various classes of them—contributory to awareness of the thing in the case of the outer sense and to awareness of the ego in the case of the inner sense. So in the psychic life they oscillate inwards or outwards, permitting the dividing-line between subject and object to be drawn anywhere between the two foci.

Of course the ability to turn the power of being aware, which belongs to consciousness, from the outer object inwards in the direction of the subject depends upon the development of the various higher forms of psychic activity (memory, imagination, thought), by which con-

sciousness can withdraw into itself and escape from the perfect dominance of the outer sense-object. Where this subjective psychic life is undeveloped or unable to assert itself, consciousness is at the mercy of its sense-objects or more or less fascinated by them (as in the case of tropism, e.g. insects flying into the fire, or of hypnotism).

So the field of the inner sense is more or less limited according to the multitude or variety of reproducible elements, developed by subjective activity. And any of these reproducible elements may be focussed by the inner sense as an object detached or abstracted from the others. But it is then apprehended as having another kind of existence than the ego or the thing, being in relation to them " unreal," though real enough as an object of awareness within its own sphere of existence. The sphere of sense (in this case the inner sense) is thus seen to cover all reproducible elements of the intermediate sphere up to the most abstract concepts or thoughts, but only when they are focussed *as* sense objects, that is to say, objects of passive awareness or observation, presenting themselves here and now, not when they are used as a means to the apprehension of an object or a reality other than themselves, which is nearly always the case in actual thought, using presentations and concepts as predicates of something. Practically no inner sense can be said to exist where the higher forms of intellectual activity are absent. But it follows in the footsteps of this higher activity, because active consciousness always involves the ability to reduce itself to a state of passive awareness.

Inwards the sense-sphere may be said to cease where the difference between the act of being aware (subject) and the thing of which one is aware (object) becomes too slight to be apprehended, the object merging into the subject and becoming more and more one with it.

When this distinction between subject and object is no more possible, the "intentionality" characteristic of all perceptive conscious acts fades away, and with it the sphere of sense. Thus the feelings form a sort of indistinct borderland in the direction of the inner awareness of the self. They cannot be discerned with the same degree of consciousness as presentations, because the act of being aware and the thing of which one is aware have here a definite tendency to merge into each other and prevent a clear discrimination. What delight, sorrow, fear, etc., are in themselves apart from the presentations with which they are correlated, we are almost unable to perceive, because they do not differentiate themselves sufficiently from the subject. We are only able to grasp them as definite objects by correlating them with presentative elements, derived from the outer senses or with organic *sensations* (not feelings) characteristic of them.

The Inner Sense and Time

A correct correlation of the inner with the outer, and vice versa, is on the whole a very important condition of sound cognition. As observation by means of the outer senses demands a subtle tact in correlating and interpreting outer sensations with the help of inner elements, so a similar tact is demanded in the case of inner observation in correlating and interpreting the experiences of the inner sense by elements from the outer. Only the tact demanded in the latter case is much more subtle and rare, because most interests in life can be satisfied without a training of the inner observation. If primitive man is a victim of the illusion of animism, modern man easily becomes a prey to the opposite illusion, making sensual presentativeness or

interpretation in the terms of outer reality a criterion of reality as such.

This last illusion has for a long time dominated psychology and culminated in the modern associationist school, preventing a correct apprehension of the more or less unsensual or unpresentative aspects of experience —for instance, thought, intuition, feeling and will. We are here confronted with a definite tendency to transform inner experience into things susceptible to a spatial or mechanical interpretation more or less like that by which law and order are understood to exist between the objects of the outer sense. But this associationist school is unable to do justice to the inner experience, the coherence of which is much more dynamical than mechanical and sustained by self-feeling. We are able by means of elements from the outer sense to single out, grasp and interpret inner experiences, but we do violence to the latter if we try to reduce them to that form of coherence which is characteristic of the spatial world of the outer sense, because they are an immediate expression of creative potencies, for which the elements assimilated by the outer sense only serve as a material of organisation.

In this tendency to do violence to inner experience by forms belonging to the outer sense or at least to the sphere of relative objectivation we have to seek the cause of a certain blindness to the fact that the self, in so far as it transcends the inner sense and forms the background of reality, before which even the inner sense must come to a halt, by this very fact at the same time transcends the forms of sense, i.e. space and time. It may, of course, roughly be said that the dominant form of the outer sense is space and of the inner sense time, because space (in connection with time) is the form by which " things " are separated from each other,

while time (and only in a secondary sense space) is the form by which we separate or distinguish between our various inner experiences. But time is not the real principle of *unity* in our inner experience. It is predominantly the analytical, not the synthetical principle of it.

The synthetical principle of inner experience, without which the analytical singling out of the individual inner experiences in time would be impossible, is the self. And what we experience as the stream-like succession of the various elements of the "psyche" belongs to the foreground of psychic life, the objectifiable, reproducible sphere. If from this foreground we turn our attention to the background or the self, we find that even this singling out in time ceases, and that the unobjectifiable background or self thus must be said to transcend time, regarded as the analytical principle of the inner sense.

Of course as a form of perception time may be applied to the self as it is applied to the parts of its experience. But then we are dividing it into a succession of selves, each with its own limited time. And when I recognise these selves as "myself" under various conditions, I refer them back to one identical self, transcending the time-periods, by which those separate selves are singled out.

The truth is, that in the self-background of psychic life the stream-like experiences or "selves" merge into the unity of the one self, and that it is impossible to understand the unity of this self as a sum or compound of selves, succeeding each other. Time ceases to have any meaning to inner experience, when we no longer have to do with distinguishable experiences singled out from the background of the self, but with this background itself in its enduring, continual identity.

And we should not be able to distinguish between

past, present and future, were it not for this time-transcending peculiarity of the self. The present self, here and now conscious of this or that object filling the foreground, to which it turns its attention, is only the more or less illuminated part of the total unilluminated self, in which past and future are kept in some way in an elevated, timeless state, from which they must descend as it were to become objects of the inner sense.

If the self filled only the present moment, how should it be able to look backwards into the past and forwards into the future? How should a self, limited by a time which it can embrace as a now, be able to add to itself the selves of the previous and the succeeding moments so as to produce one unbroken continuity, from which the various selves of the past (or phases of experience) could be reproduced? No, the present self is only a projected part of the whole self—the part by which this time-transcending self descends into the stream-like succession of individual experiences, which, as they pass, notwithstanding this passing are kept continually present by that time-transcending capacity. And when we are able from the present self as the illuminated, descended part, to look backwards and forwards in time, it is because we constantly connect and compare the time-part of the self with the timeless, unconscious or subconscious part. A reciprocal action is continually going on between them.

The Inner Sense and the Body

The fact that the body as an object of the outer sense to the inner sense presents itself in the self-feeling and the various feelings, desires and impulses so closely connected with it, may be taken as a proof of an inner connection between these feelings and the formative powers manifesting themselves in the growth of the

body. Thus we may look upon the body as a material product of powers, which subjectively are experienced in the life of feelings. To the outer sense the inside of the body can only reveal itself by dismemberment or dissection. But this inside is experienced in a totally different way by the inner sense in the more or less localised sensations, feelings and self-feeling. Obviously the formative powers of the body cannot reveal themselves to the outer sense. They can only enter into conscious experience as qualifications of the self-feeling awakening and connecting themselves with contents of presentative consciousness. Thus the source of our feelings may be looked upon as identical with the source of our body as a form, and it is very reasonable to suppose that the feelings, by which the presentative contents of consciousness are moved, are connected intimately with the formative powers of some organ or organic complex in the body, and that a healthful emotional nature has much to do with healthy organs and a harmonious relation between them.

The body as a product of the same powers which to the inner sense manifest themselves as feelings and impulses of the self is thus seen to occupy a unique position as an intermediary between the outer and the inner sense. As a geometric model it may be regarded as a link between them. On the one hand it belongs to the field of the inner sense as a basis of inner sensations and self-feeling, on the other hand it belongs to the outer sense as an object among others in the spatial world.

We have seen that we have to do with the sense-aspect of consciousness, whenever the latter is reduced or reducing itself to a purely passive state of awareness, giving the object opportunity to show itself as a present reality or something " given." And it is evident that

this sense-aspect of consciousness pervades all developments of psychic life, as consciousness is always occupied with something "given," whether this be a thing, a presentation, a remembrance, an idea, a feeling or the self. But it is also evident, that if consciousness were always reduced to the state of passive awareness, characteristic of its sense-aspect, no development of an inner psychic life would take place, because consciousness would then be at the mercy of its primary sensations, unable to comprehend them or act more or less independently of them. In addition to its sense-aspect consciousness has its active aspect, by which the various elements of the intermediate reproducible sphere are developed.

But this active aspect of consciousness is not so clearly conscious as the passive aspect. It is always the object focussed, which occupies the dominant place in the light of consciousness. The cognitive, assimilative and reactive functions playing around this object are more subjective and consequently more dimly illuminated than the object. But the products resulting from the activity of consciousness can as elements of the reproducible sphere be made objects of passive awareness.

We shall deal with this active aspect of consciousness presently. Here it may be convenient to point out that the passive sense-aspect of consciousness may be looked upon as more intimately connected with the body and its feeling-impulses than active consciousness. There is, I think, reason to suppose that consciousness when functioning as passive awareness is leaning upon the body, while in its active aspect it rises above it as it were. As a *ballon captif* is linked to the earth by its rope, but constantly hovering above it by the buoyancy of its gas, so consciousness may be said to be linked to the body by its sense-aspect while constantly lifting

itself above it by the buoyancy of its more active aspect. From this point of view the field of clearest consciousness would normally always be at the meeting-place, as it were, between consciousness and the body as the material sphere, this meeting-place being regarded as the field of sense. The body would, in its capacity of a mirror, serve to reflect all that consciousness becomes passively aware of.

But as a mirror does not *produce* the pictures reflected in it, so we must not in the body—or more especially in the nervous system—see the producing cause of that which is discerned by consciousness: sensations, ideas, feelings, etc. The real source of the contents gradually filling conscious psychic life—sense-contents as well as reproducible contents—is not the body, though a determining influence is exerted upon it by the body as the reflecting basis of its appearance in sense. As has been shown by *Avenarius* and *Mach*, the sensations are varied, but not formed by the brain, and their "introjection" into the brain is an error. On the other hand, the determining influence of the brain or body is evident enough, showing itself for instance in the phenomenon called "threshold of consciousness" (or rather of passive awareness), which is characteristic of the inner sense as well as the outer. As the perspective view of our surroundings is determined by the place of the body in space, so the power of being aware and the succession of its acts in time are dependent on the brain or body and limited by it.

Obviously the psychic processes by which the reproducible sphere is developed must continually leave "footprints" of its activity in the body or brain, though the nature of these footprints is surely misconceived if they are only conceived as purely mechanical groupings of atoms and molecules. But in any case they seem to

play a prominent part as some sort of "ropes" by which special parts of the reproducible sphere are drawn into consciousness.

But the power by which the "psyche" becomes aware cannot be limited to the passive states of consciousness. The state of awareness of consciousness does not cease when it is raised to activity, though it demands more attention, concentration and self-reflection. The sensual awareness of the outer and inner sense can therefore only be regarded as a part, though the most prominent part, of the power by which the "psyche" becomes aware. When we think, for instance, we are constantly perceiving relations between concepts, presentations and objects of sense. Thus the activity of consciousness only means an extension of its power of being aware.

But if consciousness by activity can extend its power of being aware, there is no *a priori* reason to enclose the latter within insurmountable barriers. When the active awareness of consciousness is developed and refined, much more of psychic life and reality can be apprehended by it. The relation of consciousness to outer reality is not fundamentally different from its relation to psychic reality. As the outer reality is much more extensive than the part which falls within the direct experiences of the individual, so psychic reality includes parts, or even experiences, of which consciousness is not aware, especially when its power to transcend the level of sense is little developed. Of psychic reality more or less may be taken in or consciously discerned. And that which is taken in may be apprehended more or less correctly. Consciousness may be deceived in relation to the inner as well as to the outer reality. And in order to overcome inner illusions its active awareness must be developed and refined.

Characteristic of the sense-aspect of psychic life is also a specialisation of the power of awareness in qualitatively different fields of perception by various sense-organs of the body. This specialisation is of course most conspicuous in the case of the outer sense differentiated into sight, hearing, touch. But though less conspicuous and definite it asserts itself in the case of the inner sense as well. And from the point of view here suggested there would be reason to speak of a sense, whenever a special area of the nervous system or the brain can be shown to function as a special basis for being aware of a distinct kind of objects. So we might even speak of a word-sense, a concept-sense and a self-sense, though the sounding-board of the latter would have to be extended to the whole body. The apprehension of thought must as a sense-like function be distinguished from thinking as a function of active consciousness, and similarly the self, as an object of passive feeling, from the self active in thinking and willing. Strictly speaking, the self as an object of passive inner sense is only the self of the moment. But in active intuition this self is only considered as a passing phase of a deeper subjective self transcending the time-process. The passive and the active aspect of the self are intimately connected. But the distinction between them as the self of the inner sense and the self of intuition (or active " apperception ") is important. The transcendental philosophy of Kant has its source in this distinction.

We find then connected with the passive aspect of consciousness a certain tendency to differentiation, and the influence by which this tendency is counteracted and overcome must be sought in the unifying power of active consciousness, though it may vary much in character and degree.

The Active Aspect of Consciousness

A purely sensuous consciousness without some degree and kind of activity, by which it adjusts itself to the object, is hardly to be found. Our consideration of sense-consciousness is to that extent an abstraction but necessary to show consciousness in its dependence on the object and the body as a medium of adjustment to it. Sensuous consciousness is always co-operating with active consciousness of some kind. But when dealing with the functioning of this active consciousness in man, we are obliged to look upon it from a point of view opposite, as it were, to the point of view from which sense-consciousness presents itself to us.

By the consideration of sense-consciousness we move outwards to the thing or inwards to the self. We draw as it were a horizontal line between the two extremes. But by the consideration of active consciousness we rather move upwards from the sense-object, and if this movement is to be schematised we must use the vertical, not the horizontal line. That is to say: By the active aspect of consciousness is meant its ability to rise above the object, liberate itself from it, adjust itself to it, judge about it and even use it as a material for certain ends.

This ability to transcend the sense-object and deal with it from a standpoint above it implies on the one hand a certain independence of the subject from the object, and on the other hand the unity of the two. We cannot enter into an exhaustive treatment of this question, but must limit ourselves to some essential features.

Whenever an object of sense-consciousness is to be determined in judgment it is looked upon as something real and definite in contradistinction to a more or less

extensive range of possible predicates, which the subject holds suspended as it were in itself, choosing among them that which by comparison is found to correspond to the object. So the sensual perception of an object only prepares the ground for an active determination of it by the subject. The material, by which this determination is brought about—the possible predicates—forms the subjective background distinguished from the object filling the foreground, and is primarily given to the subject as a more or less dimly illuminated circle of associations awakened by the object. But if only this associative connection between the object and the contents of the subject is seen, the most important feature of the situation is overlooked: the fact that the contents of the subject as such are looked upon as only *possible* in relation to the object as definite and *real.* The subjective elements awakened by the object are not real predicates of the latter in virtue of the association by which they are awakened, but only *possible* predicates. And it is by looking upon them as only possible, not real, that consciousness is able to distinguish between the real as given in sense and the unreal, which is *only imagined.*

So the subject may be said to transcend the object given or focussed in sense by keeping its whole sphere of reproducible elements suspended within itself in the form of possibility, as opposed to the reality of the object demanding determination. The boundary-line between subject and object or between foreground and background is therefore from this point of view always a boundary-line *between reality and possibility.* And the activity of consciousness is always mediating in some way between the real or given as objective and the possible as subjective, either transforming the real into the possible by cognitive assimilation or applying the

possible to the real in intellectual determination and action. Of course when the object is an idea, a presentation or a concept, it is unreal in relation to the reality ordinarily determined by it. But when it is made an object of determination instead of being used as a means to the determination of other things, it is real enough in relation to the sphere of possibility, from which the subject must select the predicates applicable to it.

All comparison undertaken by the subject implies this distinction between the real or actual and the possible. I can of course limit my comparison to sense-objects only. But if I bring no subjective standard or possible predicates with me to such a comparison, no result or judgment can come out of it. Comparison is not only going on between objects or elements on the objective side of the boundary-line between subject and object. It is also—though rarely very conspicuously—constantly going on between object and subject or between foreground and background. And the cognitive results acquired by the individual as well as his orientation in the world depend upon this comparison of the objects with the inherent standards of the subject.

It will easily be understood that it is a condition of psychic life, or rather consciousness, that the sense-objects must be comparable to each other. And what I mean when I say that they must be comparable, is that they must be determinable in judgment by being definitely placed in a form of coherence, belonging to that kind of existence which is the object of my cognition, but having also as my subjective possession another kind of existence in the a-dynamic form of possibility, which I can vary at will. So with space and time, which I can use subjectively as a form of construction (e.g. in imagination) as well as a form of cognitive perception and determination.

Suppose that only two objects were given to my consciousness to compare : a definite colour and a sound (two sense-impressions, each from a different field of sense), no determination of them would be possible if we were unable to fall back upon standards subjectively given and not directly present in the two sense-qualities. If I strictly limit the field of consciousness to these two objects as given and exclude from it the thought of all other *possible* variations of colour and sound, of the space *in* which they appear, of the difference of the sense-organs *to* which they appear, etc., I find them incomparable, because they *directly* show nothing in common in relation to which they can be determined. But when I admit the thought of the various degrees of intensity in which the colour and sound respectively may appear, the determination of them becomes possible by giving them a definite place in a coherent series of variations, possible to them severally. And when I further admit the thought of space and time as forms of possible coherence and order, I can determine the objects by placing them in the same or different spaces, the same or different times, etc. Objects of sense are only comparable in relation to some standard of comparison, which in addition to its definite appearance in the sense-object must be present to the comparing subject in the a-dynamic form of possibility. And in so far as such standards may be considered as abstracted from the sense-objects, this abstraction implies a transposition from the form of reality to the form of possibility or variability. In other words it implies a psychic assimilation or metamorphosis, which cannot be wholly understood without attributing to the subject some unconscious *a priori* or ideal relation to the world of sense.

The Attitude of the Subject to the Object

The way in which consciousness draws the boundary-line between the given object and its own subjective sphere of possibility comes to light in its questioning attitude towards the object. The question is expressive of the wish to ascertain which of several possible alternatives is realised in the object. It is a most important psychic fact, the implications of which are seldom adequately realised. The simplest form, in which the possible alternatives are present to the subject, is a form of contradiction or *disjunction* : yes or no, eatable or not eatable, big or small, etc. Such disjunctive questions are only possible because in the subjective sphere of possibility alternatives may coexist, which cannot coexist in the object or the sphere of reality. The object cannot at the same time be eatable and not eatable, big or small. But in my mind these alternatives, excluding each other in the object, may coexist as possibilities without excluding each other. The contradictions which the subject is always trying to remove from the objective sphere it refers to the sphere of its subjective activity, being free to think them, but only as possibilities or questions to reality.

The best illustration of this difference between the subjective and the objective sphere is perhaps the expectant attention of the hunter, constantly comparing the subjective picture of the game he intends to shoot with the objects revealing themselves to his sight in the place where he expects the game to appear. The inherent character of this expectant attention may be expressed in a constant disjunctive question : Is this the game or no ?—a question as constantly answered in the negative till the moment when the game really appears. We have here in the most conspicuous form the com-

parison between the subjective and the objective, the actual and the possible. By this questioning attitude the attention is constantly driven away from the actual to the future sensations in the hope that they may correspond to some subjectively realised possibility.

And *recognition* always implies the more or less conscious comparison of the objectively given thing with a possibility, subjectively present—as when the hunter recognises the game he expects to appear—or the finding in a real and *definite* form of something, which more or less indefinitely or dimly pre-exists in the subject. Now it is evident that recognition in some form or other is present in all cognition. Every object is something strange and foreign to the subject, if it cannot be recognised by means of a presentation or a concept present to the subject as a limited possibility of variations. For recognition it is not necessary that the reappearing object should present itself exactly in the same posture or light as when it was seen for the first time. This shows that even the individual presentation becomes more fluid as a part of the subjective sphere than it was as an actual sensation. It may vary, though within such limits that it is applicable to the " same " object.

Cognition is thus seen to imply an active subjective process in addition to the objectively given sensation. And this process may in contradistinction to sensation be called *intuition*: an active inner awareness of the nature or even the essence of the sense-object. It will be understood that the relation between sense and intuition as it is interpreted here has much to do with the relation between association and apperception. What presents itself to consciousness by virtue of association appears in a passive way very similar to that of sensation. Thus association may be said to move in the sphere of sense, while apperception brings to light

the inner necessary relations, which by the more sense-like association cannot be grasped. By connecting this duality with that of sense and intuition we accentuate the fact that we have to do with two different cognitive powers, mutually supplementing each other, or at least with two correlated aspects of cognition.

Though that which is grasped by active intuition, elicited by the sense-awareness, may be very shadow-like from a sensual point of view, it nevertheless forms a conceptual nucleus limiting in some way the fluidity and variability of the sensuous, imaginative material connected with it. It may only implicitly be present in the impression received, but it will then be susceptible of conscious explication by further activity in judgment and inference.

So cognition may be understood as a sort of mediation or reciprocal action between sensation on the objective side and an active intuitional awareness on the subjective side, the latter seeking the general nature of that which appears in sense. Cognition implies a duality: the object perceived and that *as* what it is cognised. And the root of the latter must be sought in a power of intellectual intuition, which by means of abstraction and reflection leads to the detection of the cognitive forms implied in the interpreting of sensations. We shall not enter into exhaustive investigations of abstraction. But it should be evident that there is more in this process than an analytical detachment of parts belonging to the originally given sensual material. This detachment is connected with a synthetic process as the positive principle in the formation of concepts. We may understand the significance of this synthetic process if we remember that we speak of abstraction, not only in the sense of detaching elements from a sensually given whole, but also in the sense of " looking away " from it. By this

"looking away," or reflection, the abstracted element or elements are impregnated with an intellectual *meaning* which as a sort of complement is added to the sensual material. And the process by which we become aware of this intellectual complement, even if it only consists of a simple *relation*, such as similarity or dissimilarity, may be called intuition. In science this intuition is predominantly formal (mathematical and logical). But in the domains of art, ethics and religion it shows itself in other forms.

When we look upon all contents, discerned by intellectual intuition, as "abstract," i.e. as opposite to "concrete," we do not always do justice to it. If by concreteness we mean definiteness, variety and peculiarity, we cannot say that concreteness is absent from geometry and mathematics based upon the intellectual intuition of space and numbers, though it is true that existence would be intolerably barren if this concreteness were the only one accessible to our apprehension.

Though cognition may thus be said to have a double source in sensation and intellectual intuition, it results in unities, in which sensuous and intellectual elements are intimately connected. The products of intellectual intuition do not remain on the subjective and the sense-elements on the objective side of the cognitive process. As the sense-elements are taken up into the subjective sphere, though in a state of fluidity, so we find on the other hand that the conceptual elements enter into the perception of objects, and that they may be objects of the inner sense on their own account. On the whole we find that the contents of the subjective sphere are the same as those in the objective sphere, but that in the subject these contents are kept suspended in a state of possibility by their connection with the activity of the self, sustained by feeling and will. Nothing presents

itself in the objective sphere which does not also appear on the subjective side, but here in a form of existence which must be considered from a point of view opposite, as it were, to that which is applied to the objective sphere.

The Transformation involved in Subjectivation and Objectivation

While the objective sphere is a sphere of coherence, order and continuity, the subjective sphere is *in relation to it* a sphere of chaos and contradiction. What in the objective sphere exists or is presupposed to exist in a continual coherence determined by space and time, regularity and law, reappears on the subjective side broken up into a chaos of discontinual elements and general possibilities, mutually excluding each other. While the sense-objects in objective space are placed under the sway of law, they are on the subjective side as presentations quite accidentally thrown together by association, representing a form of coexistence and succession chaotic in relation to the outer world and impossible in the latter. And in the subjective sphere the sense-objects undergo a complete metamorphosis, by which they are dissolved in elements on the one hand and on the other fused into a sensory garb for the general concepts or the possibilities of imagination and reason.

Thus the contents of the objective world, by being removed from the coherence of real space and time and looked upon in relation to the self, are thrown into chaos. The subjective sphere may therefore be said to represent the principle of contradiction as against the objective sphere, ruled by the principle of identity and continuity. But it must be remembered that this subjective chaos is a chaos out of which the cosmos of the objective world continually is born by objectivation

and identification. Within the unrest of the subject—or even by virtue of this very unrest—the questioning attitude is born, showing itself most clearly, as we have seen, in the disjunctive question demanding an answer from the sphere of sense. It is needless to add that this subjective chaos is more or less unconscious as the background from which the foreground is illuminated. By being removed from the objective sphere of coherence and identity and assimilated into the subjective chaos the cognitive elements are thrown into unconsciousness.

In this connection it must be remembered that outer reality is not the only objective sphere in which order is brought about by the cognitive process. Within the subject, or rather the community of subjects, spheres of objectivation are created by mathematics, logic, æsthetics, etc., in which special domains of material are clothed in forms of coherence.

It will easily be understood that from this point of view the subject cannot be looked upon as originally a *tabula rasa* in relation to the outer world. It must originally contain the germ of that psychic figure or personality which is realised by its interaction with the outer reality. As the body is the explication of a physical germ, so the psychic life (or the personality) must be the explication of a psychic germ connected with it. In order to function as a subject to the outer world the individual must have a "counter-world" to set up against it, not only materially, but also psychically.

But in the development of the individual psychic life the presentations and the concepts—or the *sphere of reproduction*—have a peculiar part to play. As a sphere of possibility it may also be characterised as a sphere of *negativity* in relation to the definite reality of the outer world on the one hand and the impulses of the will

demanding realisation on the other. In other words, the presentations and concepts are *unreal*. They are applicable to reality, but do not constitute it. The inherent limits of the world of possibility are gradually grasped by formal intellectual intuition as the necessities of mathematics and logic. But these necessities are negative and comparatively empty: conditions *sine qua non*, leaving room for positive determining factors in the form of sensations or will. It is evident that the reproducible sphere becomes by this negativity and unreality a medium of freedom: to be able to deal with reality indirectly in pictures and representative concepts is to be comparatively independent of it. But this negative aspect of possibility or the independence implied in intellectual insight is not the whole of freedom. The positive powers or creative potencies of the *will* must be connected with it, if the freedom of the subject is to be realised.

Thus the positive elements supplementing and interpenetrating the negativity and pure intellectuality of the reproducible sphere have a double source: the outer world and the inner world of the will. By transforming the objectively given reality into possibility, the intellect is functioning as a mediator between reality and will with its creative powers. We may characterise intellect as an eye, able to look in opposite directions—an Epimetheus and a Prometheus in one—revealing to consciousness on the one hand reality and its necessary relations, and on the other hand the possibilities open to the will, thus making it possible to the latter to develop a correct understanding of its own ideals and their relation to the outer world.

The core of the subject must be sought in the will, not as a homogeneous, blind striving, but as a unity of different impulses, wants or bents, becoming conscious

by means of the reproducible sphere. An impulse may be defined as a special striving in search of adequate objects or presentations, i.e. a striving not yet in possession of a presentation or object, but characterised by a general direction in which to seek or look for it. In feeling this general direction announces itself. If the striving in the unconscious depths of our nature can find no adequate object or presentations by which it can become conscious of its own quality and its relation to the world, a feeling of unrest and pain is the result.

The Subject as Feeling and Will

It is a remarkable fact that the psychological investigations of the associationist school generally result in an effacement not only of the will but also of the ego. Side by side with introspective analytical examinations in vain looking for the will, and always finding in place of it only a group of sensations (e.g. sensations of muscular strain), we may place similar examinations of the ego, reducing it to a " bundle " of sensations and ideas.

Here, of course, Hume opened the way with the famous passages in which he declared the self to be non-existent, because by introspection he was only able to detect special and definite sensations, ideas or feelings, but no abiding self in which they inhere. The consciousness of the ego, in which Descartes saw the culmination of certainty, seemed then from this point of view—like the will—to rest upon a foundation of emptiness. But the only conclusion which can be drawn from the psychological facts adduced is, that the ego and the will must have an unconscious or subconscious core, constantly evading the grasp of consciousness, when it tries to take it in and make it a definite object of introspection.

That the ego and will have this feature in common seems at the outset to place them in a close relation to

each other. And this impression is further strengthened when we remember the fact that feeling and will chiefly stand for the subjective side of mental life, as against sensations, presentations and ideas representing its objective side. Sensations, presentations and concepts can be inspected more closely and easily by consciousness than feeling and will, which owing to their intimate connection with the subject are not amenable to the same degree of objectification.

In reality presentations and ideas are the only psychical elements *directly* manageable by consciousness. The feelings we can only command indirectly by means of presentations, because they have a more subconscious existence than the latter. But subconsciousness is a part of psychic life which the associationists try to reduce as much as possible. We find therefore among them a definite tendency to deny that feelings have a psychic existence distinct from that of presentations and ideas. They are reduced to properties or aspects of sensations and presentations : their feeling-tones.

Obviously the subconsciousness of the feelings must be extended to the will, if we consider the latter as the real root of our feelings or the most abiding source of the driving impulses in our nature. Though an " act of the will " as a resolution to do this or that is something momentary or even flashlike, the will taken as a constitutional psychic factor, making such acts possible, must be considered as a power giving constancy and durability to our psychic life. A mind dominated by the mere casual association of ideas would be very fickle and variable, while the development of the will shows itself in sticking to definite directions or ends giving firmness and reliability to the character. And the connecting link between presentations and this abiding will we find in the feelings.

Changes of mind only involving its presentative or intellectual side are therefore considered as comparatively superficial (e.g. the acquirement of a fuller and more definite concept instead of an imperfect one or the learning of a new language), while the changes by which the feelings, and through them the will, really are altered and given a new direction, are considered the most thoroughgoing. No conversion can be said to have taken place where the will is unaffected, and the characteristic feature of conversions leading to abiding results —whether religious or spiritual in general—is the large extent to which the subconscious regions of the soul—and even the organism—are involved in them. " Though I am the same man, I consider myself changed down to the inmost marrow of my bones." In such words Goethe describes in a letter from Italy his spiritual experiences during his famous journey there. So we may say that character-building, by which constancy and continuity are given to the psychic life, depends upon the ability of the soul by means of presentative consciousness to get hold on and keep under its sway the subconscious powers of feeling and will.

And these subconscious powers represent, as we have seen, the subjective part of mental life. The essence of feeling is always to be found in the relating of surroundings, objects or ideas to the self, as representing the part of man which remains in the subjective state without merging in the surroundings or being exhausted in his objectivations or products. It is because we feel that we are able constantly to revert from the object (or the product of our own activity) to the subject, reacting in pleasure and pain, affirmation or negation. So the feelings may be said to be *in* the world, but not *of* it (in the object, but not of it), always transcending the world by relating it to the subject.

And it must be remembered that feeling has a unifying power similar to that of self-consciousness, by which the psychic life of man is united into a coherent whole. Obviously feelings lend a certain significance and unity to a group or groups of presentations, which without it would be a chaos. This unifying power of feeling shows itself in what we call "interest," the dominating tendencies of our mental life, which often—as Professor James says—make experience more than they are made by it. Even if presentations are disconnected we are able by means of a feeling to hold them together in a special unity or whole. So when in memory we are passing in review a phase of our life, embracing innumerable sensations and ideas, it is pre-eminently by some feeling that we grasp it as a unity.

When we pass from the presentative side of consciousness to feeling, we are therefore passing from the object to the subject, from a multiplicity of impressions and ideas to the factors in psychic life by which this multiplicity gains a subjective meaning and unity. But though feeling on the presentative or objective side of psychic life is illuminated and made conscious, it merges on its subjective side into unconsciousness, unable wholly to illuminate the inner nature of the self and only showing it as an unknown x in its *relation to* the known or objective factors of consciousness. As this x stands for the unrealised and unobjectified part of our nature —the animating principle of our activity—it is reasonable to suppose that it has the character of will.

Degrees of Consciousness in relation to Presentation, Feeling and Will

But it may be asked how feeling and will can vanish partly or wholly under the analysis of the psychologist,

when they are considered by " the man in the street " as an integral part of his experience. As fundamental concepts in every-day life, feeling and will surely must have a very important foundation in experience. The best answer to this question seems to me to lie in a distinction made by Dr. Rudolf Steiner in his book *Von Seelenräthseln*. He says that our consciousness can only be said to be in a waking state in reference to presentations and ideas. The consciousness of feelings does not rise above the dream-state, while the consciousness of will may be compared to the state of a dreamless sleep.

This at the outset perhaps somewhat startling assertion is fortified by a simile. As we may be said to see the various colours of the spectrum *positively* by their own contents, while blackness or darkness only means the absence of colour and therefore may be taken to represent the *negation* of sight, so presentations and ideas are apprehended positively by consciousness, while will is only apprehended negatively, i.e. as something which is *not* presentation (or feeling). In other words, the presence of a conative process is made known to consciousness only by something which, from the standpoint of presentative consciousness, must be characterised as " holes " in the coherence of ideas or rather as an x in connection with them. And this x will be reduced to nothing if we demand to apprehend it in the same way as we apprehend the contents of presentations and ideas. But this is what the analytical psychologist often demands. He wants the *same* consciousness of will as he has of sensations and ideas, and as this is impossible, will disappears under his analysis, while the " man in the street " is content with less and therefore satisfied with the apprehension that " something is moving " behind the presentations and ideas, which cannot be identified with them.

As our waking state of consciousness is interrupted by sleep, constantly making " holes " in the continuity of our waking life, so the will-side of our psychic processes is as it were " slept away," while the feeling-side of them is moving in a dream-state, leaving only for the presentations a clear waking consciousness.

This view of presentation, feeling and will may be useful quite apart from the question about a higher cognition which Dr. Steiner connects with it. We may content ourselves with the fact that feeling and especially will is not apprehensible in quite the same way as presentations are—i.e. in a passive sense-like manner. I think we may say that will is apprehended intuitionally, not sensually, and therefore imperfectly, because intuition is comparatively much less developed than sense. The apprehension of the self implied in active self-consciousness, not in the passive self-feeling, may also be considered as intuitional. At the root of self-consciousness we find will, which only in man can be said to exist individualised as self-will. Will may be said to be a constant source of self-consciousness, but it is as constantly veiled by the consciousness elicited by it. In other words: the self as will is hiding itself and its inner nature by the very act in which it reveals the *objects* of consciousness.

Obviously self-consciousness is intimately connected with self-feeling, which, as we have seen, may be looked upon as the inner sensual reflex of the body. The important part played by the body as a basis of our self-identity is therefore not marvellous. Professor L. P. Jacks has very trenchantly set forth the significance of the bodily form as a means to ascertain the identity of the persons with whom we have intercourse. I think that by unprejudiced reflection we shall find our body of no less importance to the consciousness of our own

subjective identity. The continual presence of our body during waking life as a support for our habitual self-feeling makes it very difficult to realise the revolution of consciousness implied in its dropping out of existence.

But it must not be supposed that this fact necessarily implies a materialistic view of the body as the producing cause of psychic life. The relation of the body to conscious psychic life is best understood if we regard it as a mirror built up and organised by unconscious psychic impulses. Conscious psychic life may then be considered as that part of our spiritual life and nature which in the present phase of human development can be reflected by the bodily mirror. Our personality as we know it in waking life may thus be compared with the reflected picture in a mirror of our bodily form, which in reality contains much more than the picture reveals. We should therefore distinguish between our conscious personality and its spiritual source, which is not embraced by waking consciousness, because the body is unable to reflect it.

From this point of view the difference in degree of consciousness, characteristic of presentation, feeling and will, may be taken as expressing a difference in the degree of development—presentative consciousness being more developed than feeling and feeling more than will. The perfect man would then be a man in whom the hidden powers of feeling and will had reached the same level of development as presentative consciousness. Obviously the artistic, moral and religious impulses or ideals have their root in feeling and will, but not in those phases of them which are reflected by the body and manifested in bodily instincts. In other words, the real source of those ideals is not the *sub*consciousness connecting psychic life with organic life, but rather *super*conscious-

ness, embracing those parts of feeling and will which the body in its present state is unable to reflect, and which therefore remain in a comparatively unreflected potential state during waking life. This does not prevent there being an inner connection between the potential ideal powers of superconsciousness and the subconscious instinctive impulses of the bodily organs, showing itself for instance in the fact that the higher ideals demand a purification and metamorphosis of the lower impulses, leading to a sort of spiritual resurrection of the man of the flesh.

CHAPTER II

PSYCHIC AND ORGANIC LIFE

TIME AS THE FOURTH DIMENSION

We may perhaps now approach the question of the fourth dimension in relation to consciousness or the psychic world. In physics a revolution seems to be going on caused by the theories of relativity formulated by Einstein. There is a tendency to reject old-established conceptions such as the absoluteness of space and time and the disparity between them, the ether, the action in distance, etc. In place of all this we have got a four-dimensional world or continuum, or rather a mathematical scheme as a means of interpreting and determining physical processes. In the light of this scheme, space and time as intuitional and absolute factors vanish. In this connection a sentence in a lecture by the mathematician *Minkowski* has become famous: "From now onwards space and time considered separately must sink down to shadows. Only a sort of union between the two will remain independent."

When time as a fourth dimension is co-ordinated with the three dimensions of space, we get a space-time-world, the four-dimensional absolute world of Minkowski, in which every point must be characterised as a "space-time-point" or "world-point," because not only a certain place in three-dimensional space, but also the moment when this place is occupied by the point, is represented by it. The difference between the spatial point and the moment disappears and with it the difference between a distance in space and a distance in time;

because the succession in the occupation of places, by which the movement of a point through space is characterised, presents itself in the four-dimensional " absolute world " as co-existence in a world-line or space-time-line, by which the distance in time as well as the distance in space is represented.

Though this four-dimensional world may be pictured spatially, it is in itself neither a space- nor a time-world. It might perhaps as well be called a world of one-dimensional continuities determinable by four co-ordinates. But these co-ordinates have no longer any real intuitional space- or time-character. They are rather pure numeric quantities, to which mathematics reverts, as the only means of objectivation compatible with the relativity and consequent subjectivity of space and time. The four-dimensional world is only mathematically or quantitatively determinable. Qualitatively it cannot be apprehended. Intuitionally space and time are relative to the observer, i.e. they vary with the subjects and the systems to which they belong. In this relativity and subjectivity we have to seek the cause of the disparity between three-dimensional space and one-dimensional time, as they appear to us. The distances observed by measurement between two points in space or two moments in time are not invariable, but dependent on the standpoint of the observer and his state of motion.

The union of space and time thus brought about by the modern theory of relativity has in this way led to a mathematical abstractness thinner and more subtle than ever before. If space and time are reduced to mere shadows or phenomena, they are not replaced by something more substantial, but by a shadow-like mathematical scheme, representing the acme of quantitative abstractness. This four-dimensional scheme we shall not here take up for discussion. But it should be noted

in this connection that, when the relation between space and time is considered from the standpoint of ordinary observation, the union of them should not lead to a more abstract, but to a more concrete, view of the world, because a definite filling of space and time is that which constitutes concrete reality. Now it may be said that the " absolute world " of Minkowski demands the utmost concreteness of our imagination, in so far as the movements of all " material points " in the universe are mirrored to its four-dimensional view as an infinite complex of interrelated world-lines, in which the successions in time are given as one eternal or timeless presence. But as it is impossible for imagination to realise such a world-picture, the only gain left us by this subtle reasoning is a mathematical formula or numerical scheme.

It is, however, important to note, that in interpreting the sensual world around us we are disposed to abstract from time and to favour space or the three lower dimensions. In studying the " thing " we look upon it as a stationary whole consisting of spatial parts, the interrelation of which we try to understand. Its duration in time or its movement with the earth and the solar system in the universe we do not take into consideration. And in geometry it is a silent presupposition that the figures constructed in space remain congruent in the course of time, that for instance the distance between two points in space is the same in all the different moments of time. In the mental development of the child the consciousness of time comes later and with more difficulty than the consciousness of space. The child lives in the present revealing itself in sensual space. It is interested in the *things*, not in the time-relations between them. But the consciousness of time is thrust upon it, when it is obliged to *wait* for a desired object. Then duration or time is perceived.

It is intelligible that we are disposed to interpret reality by means of those aspects which we are able to grasp most clearly and manage most freely in our constructive imagination and action. This is the cause of a certain abstract one-sidedness in the interpretation of reality by which important aspects may be eliminated out of our view of the world or reduced to a subordinate place at variance with its true place in objective existence.

Because the three dimensions of space are the most prominent and clearest aspects of the objective world, we are disposed to neglect time, or to consider it only so far as it can be expressed in the terms of three-dimensional space or mechanics. We come to the lower dimensions of reality by abstracting from the higher or by putting them out of consideration, and the lower dimensions thus placed in the foreground will always be the simplest and clearest to cognitive consciousness. So we get the three-dimensional body by abstracting from time (and the qualities of sensual objects). By further abstracting from the third dimension I get the plane and by abstracting from the second dimension the line. This way of reductive abstraction is easy enough to go. But the opposite way of concretion—or adding higher dimensions to the lower—is beset with traps.

Here it is above all important to remember that it is impossible to develop a higher dimension by a mere addition of factors belonging to the lower. I cannot produce the idea of a plane by an addition of lines, nor the idea of a three-dimensional body by a mere addition of planes. I can only come to a realisation of the higher dimensions or aspects of reality by virtue of the fact that they are inherent possessions of my nature, the consciousness of which is dependent upon my ability to manage them subjectively as constructive possibilities

(of imagination and motion) in contradistinction to the objective reality in which they are manifested. Owing to this inherent " a-priority " of the higher dimension in relation to the lower, the factors of the latter can only function as material for the conscious realisation of the higher.

Therefore I cannot put the higher dimensions together by means of the lower. I cannot understand time by means of three-dimensional space only or its parts, and so long as I hold time in abstraction from spatial reality or place it in a loose and superficial relation to the latter, I have a one-sided spatial view of reality and cannot do justice to it in its time-aspect as " an ever-streaming river," intimately uniting its space- and time-character into one whole.

We are always tempted thus to waive time in the interest of presentative clearness. In the same degree as I permit the spatial world to merge into the ever-streaming time, the clearness of the world-picture suffers. It becomes too complicated. The eleatic rejection of motion, change and becoming is thus quite intelligible. If we have three-dimensional space with all that fills it as a stationary whole absolutely resting in itself, how can anything new arise in it, any change or motion ? How can real development take place, resulting in something which did not exist before ? In this space all is seen to be what it must be by virtue of its inner coherent continuity in all directions. All seems complete and nothing wanting. The real seems everywhere present in the fullness of its reality, and how should anything be or become what it really is not ? It is only when we look upon time as *originally inherent* in reality (object as well as subject), not when we try to introduce it from without as it were into a three-dimensional space apparently complete in itself, that we understand motion,

becoming and change. If time is only seen in an abstract relation to space, it is logically correct to say that Achilles cannot overtake the tortoise.

By making time the fourth dimension of space, or rather by considering it as an inherent aspect of spatial reality, we are thus no doubt progressing from an abstract to a more concrete conception of reality. But in mechanics this union of space and time is only considered in so far as time can be spatialised or expressed in the terms of three-dimensional space only. Time is here looked upon as the prisoner of space. It has no ruling power over it. A mechanical view of the world is therefore unable to do justice to the higher possibilities connected with time as a dimension of reality. The organic and the psychic world cannot be included in the reality thus conceived.

The Fourth Dimension in relation to the Subject

Time as a fourth dimension of space is not a new thought. Among those who have suggested it we find A. F. Lange and Lagrange. But especially G. Th. Fechner deserves to be named as a pioneer, who has dealt with it in a most excellent and interesting way in an essay to be found in his *Kleine Schriften* (published anonymously under the pseudonym of "Dr. Mises"). He takes his starting-point in a world of two dimensions and reminds us that if a picture of a man, reflected in a camera obscura, is looked upon as living, it would exist and move in a plane only, that is in two dimensions. Of the third dimension it could have no conception. But if we picture to ourselves a continual displacement of this hypothetical two-dimensional being through the third dimension, the latter would enter into its experience *as a succession of different two-dimen-*

sional states. That is to say: the third dimension surveyed by us as a present extensive whole would to this being exist, but disintegrated into a time-succession. It would say to itself: "There is a time in which all changes, myself included." But to us *this* time is only a continual coherence of planes in the three-dimensional world of bodies, existing *beforehand* as a whole. And Professor Fechner adds: "We too say: there is a time in which all changes, ourselves included. What is the reason of this? The movement of our three-dimensional space through a fourth dimension. But of this movement we experience only the time-succession or change."

The idea of Fechner will become very significant if we take it to mean that the higher dimension, to a being unable to rise above it in active intuition and construction, must present itself to it as a time-succession, while a being able to transcend it would look upon it as a continuous whole. It must be kept in mind that if a dimension is to present itself in such continuous wholeness to a being, this being must *as a subject* be able to transcend it and operate with it in a free constructive way. It is not enough to *exist* subjectively—or in other words to live unconsciously—in the higher dimension. This dimension must be objectified, must be set outside the unconscious part of the subject as it were and be made a subject-object, i.e. an object which the being is able to master subjectively as a form of constructive activity as well as a form of objective perception. By such objectivation—enriching in the same degree the subjective and the objective sphere of cognition as mutually dependent on each other—the dimension will become conscious in the most precise meaning of the word. So long as we only *exist* in a higher dimension or unconsciously live in it unable to objectify it to ourselves in this way, we are ruled by the dimension as a universal aspect

of reality instead of mastering it. In this case we have the dimension in question on the subjective, unconscious side of our nature, veiling to us a domain or an aspect of reality, which otherwise would be open to our insight. The dimension is then functioning as a limit to our conscious psychic life on its subjective side.

And it must be remembered that if I am to objectify a dimension in this way by transcending it, I must do it by virtue of my *existence* in a next higher dimension, which I still have on the subjective side, hiding the corresponding aspect of reality. So the idea suggested by Fechner may be worked out in the following way: a two-dimensional being is a being able to move and construct freely in a plane world, while subjectively and unconsciously existing in the third dimension. A three-dimensional being is a being able to move and construct freely in a three-dimensional space while unconsciously living in the fourth dimension.

The essential feature in relation to three-dimensional space is our ability to master it in free construction and creation. And the question here to be answered is whether our relation to the fourth dimension which we experience as time is of the same kind. It is evident that we are able constructively to master time (in memory, expectation and imagination), but only in a limited degree. We have not time under us as it were or *wholly* objectified in the same sense as space. Time reaches deeper into the subject than space, and by reason of this subjectivity more of its domain may be called unconscious. But in the same degree as the subject is able to survey time (in memory, imagination and thought), it can only do so because it *lives* in a dimension of reality still higher than time-succession, and because the higher dimension implies the lower. It is evident that the aspect of reality by which the subject is able to

survey time is the aspect revealing itself to it as the "ego," the unobjectifiable part of psychic life, the subjective limit of the reproducible sphere. Or if we remember what has been suggested in another connection, that the succession in time is the analytical aspect of a psychic life, which in its synthetic aspect is known to us as the ego, we might say that in ordinary memory and imagination we learn to know from the analytical or peripheric side what in its true synthetic or inner nature is hidden to consciousness by the self.

Now the view suggested by Fechner, and here enlarged upon in the light of the relation between subject and object, is of course a fictitious one, in so far as one- and two-dimensional beings do not exist in reality. But apart from this it is well adapted to show the relation between space, time and even time-transcendent aspects of reality, when the position of the subject is kept in mind. Much misunderstanding has resulted from speaking of the fourth dimension *of space* and trying to picture the fourth dimension as a new direction of spatial extension in a rectangular relation to the third dimension—an impossible undertaking because it implies the contradiction of picturing four-dimensionality as in some way three-dimensional. It is needless to say that dimensions here are conceived as aspects of reality, the lower implied in the higher, but not all of them spatial in character. It is true that the objectivation of time as a fourth dimension—brought about by the subject transcending it—must result in the surveying of discrete successive moments in time as one coherent whole. But this does not imply the perception of this whole in such a way that it can be added to the three dimensions of space as a new *rigid* co-ordinate on a line with them. We falsify reality if we try to stuff the higher aspects of it into space, and fancy that we do justice to them by

treating them mathematically as rigid co-ordinates only of spatial reality. The tendency to do this has been characterised above as an unwarranted translation of data from the field of the inner sense into data of the outer.

The theory of relativity does not speak of the world as a rigid one from the four-dimensional point of view. It seems to limit itself to an extension of the concept of motion so as to include time or succession in it. Instead of speaking of motion as taking place " in " time and placing time or succession in some relation of indifferent abstractness to the movement, it permits the time-succession to be swallowed up as it were by the latter. But this is altogether insufficient to give us a true conception of time as a fourth dimension, by which three-dimensional reality can be *mastered*, because it only shows us time in its impotence as a prisoner of spatial or even mechanical reality. It is not possible to come to a true conception of time as a fourth dimension of reality, if we only study the mechanical world or the world of motion. We must enter the subject in its relation to " outer " reality. Time cannot be apprehended in its true relation to space when it is considered apart from the subject and its psychic life.

It is stated that the objective time of natural science is something altogether different from the time of psychological experience, and in physics time as the fourth dimension is therefore commonly studied in abstraction from time in subjective experience. But from the foregoing it will be evident how intimately this question is connected with the subject-object relation. In reality the essence of the problem of four-dimensionality is to be found in the relation of psychic life to the physical processes in nature.

And when we pass from the world of physics to the

subjective world of psychology we find that an essential change is taking place in the relation between space and time. The difference may be expressed by saying that while time in the world of physics is a vehicle of space (or spatial changes) it is by psychic life made dominant, so that space here may be considered as a vehicle of time. In the physical world time is a prisoner of spatial motion or change, serving only to show motion as a spatial function. We have in physics as it were space speaking to us by means of time. But in the psychic world this relation is inverted. Conscious psychic life does not unfold itself in the world of physical motion. But it is not lifted out of all relation to space. What we picture to ourselves in memory and imagination we endow with spatial qualities. But here the spatial qualities and relations are only a vehicle of time as the form of succession by which they are imagined. Thus it may be said that time in psychic life is speaking to us by means of space.

In memory we move freely through time independently of the events in objective space, and in so far as space is present in the pictures and presentations of memory it is there only as a servant of our psychic movement through time. So we may say that in the physical world we move (for instance, when we are walking or writing) through space by means of time, while in the psychic world we move (in memory) through time by means of space (or spatially qualified presentations). Time is in the " psyche " the dominant dimension, and its real superiority to the lower dimensions hidden in the world of physics appears in the fact that by means of imagination developed in connection with memory we can picture to ourselves a variety of possible movements to be undertaken by us in the physical world, and follow the " plan " thus conceived in our real move-

ments. So it is only when the psychic world is taken into account that it becomes evident how by means of the fourth dimension we can *interfere* in the physical world.

The Sphere of Motion and the Sphere of Association

Of course this inversion of the relation between space and time in the psychic world is only possible because space is here no longer "real" space, but only the plastic constructive possibility of imagination. It is only the canvas upon which the subject is painting its pictures of the real world or its own wants and wishes. In relation to the real world the psychic is only a world of possibility, where I can imagine an endless variety of possible spaces and time-successions.

The point of contact between this psychic world of possibility and the "real" world is sensation, because by sensation the "psyche" is partaking in the happenings in real space and its own movements in it. The change taking place in the relation between space and time by the transition from the world of physics to psychic life will therefore be made clearer when we compare the sensation with the presentation developed from it in the mind.

The difference of presentation from sensation is very superficially characterised when it is stated that presentation is a faint shadow-like and indefinite copy of sensation. A much more essential difference appears when we consider their relation to motion and time, because then we must say: by sensation we are partaking of real spatial motion, studied by physics, and the time implied in it. But in presentation we transcend this sphere of motion by adhering only to the time-aspect of sensation as different from its motional

aspect (or its place in the coherence of space), and by using this time-aspect as a means of reproduction, independently of spatial motion. So the time-aspect of sensation (its place in the succession of perceptions) is the means by which the subject is taking hold of its contents, keeping it as it were suspended in a psychic state above the sphere of spatial motion.

In the sphere in which we are partaking in sensation we are obliged to move about to obtain the sensations we desire, but in the sphere of presentation we do not need to move our limbs to realise the desired imaginations and memories.[1] By transition from the first sphere to the latter the contents of sensation are lifted from the sphere of motion to the sphere of *association*, which is a world of time. As association by contiguity, underlying memory, is essentially a law of succession and coexistence in time, we need not dwell upon the part played by time in association.

The transition from sensation to presentation (or reproductive memory) is an emancipation from the sphere

[1] The processes of psycho-physical life are commonly reduced to a fundamental form, represented by the so-called reflex-curve, i.e. a figure illustrating how irritation in the sensitive nerves awakened by stimuli from without is transmitted to the brain, causing a psychic experience there, and how as a result of this centripetal process the motor nerves are stimulated and a motion of the limbs produced. But this reflex-curve beginning and ending in the sphere of motion and making the psychic experience a more or less dispensable intermediary link between the centripetal and centrifugal part of the curve is no true picture of the relation between psychic experience and motion, though it of course may be very useful to scientific investigations of the nervous system as a basis of psychic life. If the relation between psychic experience and motion is to be represented from the point of view of the subject, a curve of the opposite character would have to be constructed, i.e. a curve beginning in a conscious psychic experience, descending into motion and ending in a new psychic experience. Such a curve making motion an intermediary link between two psychic experiences would illustrate that motions of the limbs to the " psyche " are always means to obtain new sensations or psychic experiences.

of spatial motion by means of time. In a *transferred* sense the word movement may also be used about the psychic process of association, by which presentations mutually call each other forth. But this movement is a movement through time, not through space, and it is only made possible by the fact that the spatial qualities of presentations are detached from the sphere of motion and kept suspended above it as imaginable possibilities, more or less manageable by the subject.

It is evident that such transcendence from the sphere of motion to the sphere of association is only possible because time as a dimension is something which we inherently have at our disposition. If it were not implicit in our activity we should not become conscious of duration or time-succession. As we get no real space by a mere addition of sensations spatially qualified, so we get no real time by a similar addition of them as disconnected successive moments. Time is something inherently given in the constitution of reality, but our consciousness of it is dependent on the transcendence just described.

As we should have no consciousness of space, if we were incapable of self-movement in it, we should be unconscious of time, if we were incapable of a similar self-movement in it by virtue of associative memory. The stone exists in space, but has no consciousness of it, because it cannot move, but only be moved. The animal exists in time, but has no consciousness of it, because it has not developed memory as a free, spontaneous self-movement in time.

This self-movement is not inconsistent with our partaking in a universal movement. By the fact that we are immersed in or partaking in the sphere of motion, we are also partaking in the time or succession represented by it, but in a way for which we are not ourselves

responsible, implied in the motion of the earth. With the sphere of motion we are constantly advancing from the present into the future. But this advancement in time is going on quite independently of ourselves, which is not the case with individual memory and expectation, enabling us spontaneously to go back through time in memory as well as forwards to events in the outer world.

What is the difference between this self-movement in time and the time-advancement, in which we are partaking without any responsibility on our part merely by our existence in the sphere of motion? The difference is the same as the difference between universal movement and self-movement in space. As the universal movement (with the earth, the steamship or train) is no hindrance to my self-movement, so the universal advancement in time by our existence in the sphere of motion is no hindrance to a certain self-movement in it. And as there is no fundamental difference between universal movement and self-movement in space, so there is no fundamental difference between universal time-advancement and memory. Looked at from the point of view represented by the sphere of motion and universal time-advancement, memory is no exception to the processes by which this universal time-advancement is taking place. The time in which the reproductions of memory are going on is part and parcel of the universal time-advancement in the sphere of motion. But though this partaking in the universal time-advancement is not suspended by individual memory, the latter can in its own sphere move backwards in the same time in which it is moving forwards as partaking in universal time-advancement. Such advancing and receding at the same time would of course be impossible, were it not for the fact that the subject is contemporaneously present in two spheres, one universal and the other

individual, advancing in the one while receding in the other. Or we may say, that the subject is advancing in the real sphere, but receding in the presentative or ideal sphere.

Thus we see that in the sphere of associative memory the individual transcends the sphere of motion, but not the sphere of time. Time, but not motion, is common to both spheres. In the individual " psyche " we have only to do with succession, not with motion. Now succession is involved in motion, and by virtue of this fact the " psyche " can be immanent in the sphere of motion, primarily in its own body and its movements. But on the other hand motion is not necessarily implied in succession, a fact making it possible to the subject to rise above motion by appropriating succession or a force realising itself by succession without material motion. The association of ideas may as a psychic process not involve energetic processes in the physical sense of the word. But in an extended sense we may call the force, by which the associative coherence of presentations and ideas is brought about, a time-energy or energy of succession in contradistinction to space-energy or energy of motion.

The energy, then, or the power, by which presentations and ideas are linked together and organised, is an energy realising itself in time only as a sort of superspatial motion, but manifesting no pushing power such as the real spatial motion of matter. But we must beware of looking upon this power as the *producing* cause of sensations and presentations. The *contents* of sensations or presentations cannot be derived from it. But it is obviously a power by which consciousness is *getting hold* of these contents, placing them in more or less degree at its disposal as a material of psychic life. And as the power by which the subject is getting hold of the

contents presented to it is its power of becoming aware, the power to associate must at least be intimately connected with the power of consciousness to become aware. As is well known, the associative coherence of ideas is pre-eminently brought about by the fact that they originally are discerned together or in close succession. Some associative power must therefore be working inherently in conscious awareness, resulting in the tendency to a renewed " co-awaring " of the links associated. Obviously the simplest form in which the power of awareness transcends the purely sensual level is feeling, with which association and reproduction are originally closely connected. But it will be understood that the power of awareness involved in the feeling by which presentations in the first instance may be developed from sensations, must be involuntary and passive. It cannot be identified with the active awareness of clear self-consciousness.

By sensation a *spatial* world is perceived as immediate surroundings of the organism functioning in it as a subject-object by virtue of its self-feeling and self-movement. So sensation and reactive movement can only lead to a preliminary realisation of space, not of time, which is yet hidden by the veil of subjectivity. It is only when self-movement in time connected with a psychic (not purely organic) self-feeling is added to self-movement in space, that consciousness of time is fully realised. But the presentative psychic life thus developed as something comparatively independent of the spatial world of sense is nevertheless intimately connected with it. The world of sensation reappears in the world of presentation, though transmuted into pictures and possibilities. And there is nothing in the world of sense which could not be copied in imaginative dreams forming themselves independently of the organs of sense.

Organic and Psychic Life

The sphere of motion includes *all* material movements, not only those by which organic beings obtain the sensations which they desire, though such movements may be the first to implant the idea of motion in consciousness. But within the sphere of motion the processes by which the material organism is developed and maintained have a peculiar place owing to the fact that presentative psychic life always must have such a material organism as its basis. What is the relation of presentative life to the organism as a part of the sphere of motion? On the one hand, presentative life may seem to be very independent of this basis, when we are so absorbed in memories, imaginations and thoughts, that the outer world, the body included, is forgotten. On the other hand, the indispensability of the organic basis, especially the nervous system and the brain, to presentative psychic life is a fact so evident, that we need not here dwell upon it. But what is the *nature* of this dependence? Obviously the brain cannot be the *producing cause* of presentative life. The difference between the material brain and presentative life regarded as a product of it is too great to allow such an explanation. The brain cannot be looked upon as an organ of consciousness in the same sense as the stomach is an organ for the preparation of the blood and the lungs organs for the purification of it. No material processes going on in the brain can make presentative life intelligible as effects of such processes.

We shall not here take up for discussion all the intricate questions connected with the problem of the relation between the brain and the "psyche." What I wish to point out is, that this relation is best understood if we assume that the development and organisation of

conscious psychic life (here of course including sensation) is taking place at the cost of vital power or entelechy, which according to vitalistic conceptions is underlying the growth and formation of the organism.

There is not much hope now of explaining organic life wholly as a result of mechanical and chemical forces. A superior directing and organising power belonging to a higher level of existence than the energies working in the inorganic world is widely supposed to play an essential part in the building of organisms. And if so it is an obvious conclusion that this vital power must function as an intermediary between conscious psychic life and the body considered as a complex of material motions. Psychic life does not appear in connection with inorganic matter. It is therefore reasonable to suppose that the power by virtue of which the organism is *living* has something to do with the possibility of psychic life to develop and manifest itself in connection with it.

If we look for some characteristic of vital power we find that it—like the conscious psychic power—implies a time-transcendence above the level of mere material motion. In the organism the material motions take place in such a way that an individual time-organisation is formed, showing itself in the various ascending and descending phases in the life of the organism between its birth and death. We may therefore call the vital principle a time-power *unconsciously* transcending the sphere of motion, as it *consciously* is transcended by means of the psychic presentative life. Consciously we are partaking of the sphere of motion by means of sensation, from which presentative life is developed. But apart from sensation we are also partaking of the sphere of motion in an unconscious way by means of the vital power building up and maintaining the organism. The near relationship between vital power and psychic life

is thus evident. And if we look for some factor in which this relationship is especially apparent we find it in the impulses which we experience psychically as desires or appetites. It is not so difficult to understand that such impulses may be immersed in the organs of the body and work unconsciously in them, so long as they have no ends outside organic life. It is only when ends outside the body come within the sphere of their work that they become conscious, and develop that power of awareness by which sensation and presentation come within the organising power of the subject.

Strivings, impulses, appetites, etc., cannot be identified with physical energies in so far as they are working in definite directions and for definite ends. They may work blindly and unconsciously when their objects or ends are immediately present to them in the material states of the organs or the organism as a totality. But they may also work consciously, e.g. when the physiological impulse realising itself in the digestion is checked by want of food and makes itself felt as hunger. In the case of such transcendence above the sphere of unconscious organic work, the material organs as immediate objects of the work of the impulse are replaced by sensations or presentations reflecting the nature of the impulse and making it in a greater or less degree conscious. So the hunger is connected with *pictures* of its object. But compared with the immediate and stationary object of the organism, sensations and presentations are constantly shifting objects presupposing on the part of the striving subject a *questioning attitude*, ready to approach and run away, to accept or reject according to the nature of the sensations and presentations.

In such a questioning attitude the peculiar nature of the *conscious* psychic life appears in its difference from unconscious organic life, where there is no room for

questions or waverings between different alternatives. To be questioning is in some sense or degree to be awake or conscious, capable of being aware of sensual and mental contents and reacting in relation to them. Psychic life has its material in sensations and presentations. But the power by which it is organised—at least in the first instance—consists in desire-like impulses, not fundamentally different from the physiological impulses of organic life.

The bridge, then, between organic and psychic life may be sought in such impulses. We may imagine how impulses working outwards as it were in the sphere of motion by the organisation of the body may be checked in this work and thrown inwards, giving rise to a sphere of subjectivity and consciousness. So the development of consciousness may be understood to imply a checking of the work of mere physiological impulses, leading, not to an annihilation of their activity, but to a transformation of it, by which subjective states of awareness, questioning, wavering, interest and expectation arise.

But such transformation of physiological impulses would involve the presence within the organism of a power able to effect it—a psychic power, which does not descend to the level of a purely organic work, because its nature and possibilities can only be realised on a psychic level. As heat is necessary for the transformation of ice into water, as the oxygen of the air is necessary for the transformation of the oil in a lamp into the burning and shining flame, so the transformation of vital power into power of awareness can only be understood by supposing that the organic nature of the body is intimately connected with a psychic nature, realising itself by the consuming of vital power.

If this is kept in mind the function of the brain as an organ of psychic life will be understood to be rather negative than positive. In other words, the brain

makes psychic life possible by a sort of organic self-sacrifice or dying. It gives itself up by renouncing organic life in order that psychic life may develop and prosper. Therefore the psychic processes connected with the brain cannot be understood as positive results of its activity on a level with the organic results of the activity of other organs in the body. They are only dependent on the brain as a basis of the transformation necessary to the objectivation of a more or less extended reproducible a-dynamic psychic sphere.

A simile may profitably be used to illustrate this relation between the psychic life and the brain. The natural destiny of the corn is to be taken up by the soil and develop into new plants. But it is deflected from this natural destiny when it is baked into bread and used for the nourishment of the human body. So the *natural* destiny of the vital power in the cells of the brain would be a continuation of the organic activity: cell-division, growth, etc. But as a basis of psychic life it is deflected from this course and used to develop a conscious psychic life in connection with the body. In other words, the power to react on stimuli inherent in every living cell is here heightened and developed in a psychic direction at the cost of the material organic activity of cell-life.

So vital power is consumed by consciousness, as the oil in the lamp is consumed by the flame. And as the lamp must be filled with new oil, when the old is consumed, so the vitality of the brain must be renewed at regular intervals if the brain is to remain a suitable basis of psychic life. This is done in sleep, when unconscious organic life practically holds the ground alone. Prolonged waking life uninterrupted by sleep leads to weakening or even softening of the brain, while sleep seems to fill it with new vitality, refreshing waking consciousness with new power and agility.

Thus we find a certain antagonism in the relation between organic life and consciousness, the latter being realised at the cost of organic life, while organic life is realised at the cost of consciousness. Or we may say : the power to direct physical energies, involved in organic life, is in some way incompatible with consciousness, while the power to be aware and to organise psychic elements which pertains to conscious life is gained at the expense of the power of physical organisation.

A general consideration of the relation between plant-life and animal life will make this antagonism very plain. If we compare animals as bearers of desires and sensations with plants, in which a psychic life of this kind is absent, we find in the animal comparatively less capacity for organic growth than in the plant. While the plant grows during its whole life, the organic growth of the animal is restricted to a limited period of its life : youth. Exceptions to this rule are found only among lower animal forms. In the higher animals the completion of organic growth seems only to give so much more opportunity for the unfolding of conscious psychic life by means of the nervous system. So we find that the turning-points in the growth of the human body (the changing of teeth and sexual maturing), by which organic unfoldment in some special respect is completed, give rise to a richer psychic unfoldment. After the changing of teeth comes the definite development of memory and intelligence, while the development of individual will-power and the feeling of personal independence naturally follows upon sexual maturity. Thus conscious psychic growth seems in some way to be conditioned by a limiting and finishing of organic growth.

As psychic unconsciousness is characteristic of organic vitality and activity, it will be understood that consciousness is more intimately related to the death-processes

than to the life-processes of the organism. If death is taken to mean the destructive or disintegrative side of organic activity in contradistinction to the constructive side, death may be said to be an integrative part of the processes by which the organism is built up and maintained. Life is sometimes designated as an autonomous material metamorphosis with an ascending (ectropic) and a descending (entropic) tendency, the former appearing in growth, the latter in decay. The one tendency may outweigh the other (growth in youth, decay in old age) or they may balance each other. The living plasm has the power to effect autonomous changes in both directions in comparative independence of influences from the outside. But in relation to inorganic nature the characteristic of organic nature is a preponderance of the ectropic tendency. This preponderance is, however, counteracted by consciousness, which is realised at the expense of the ectropic tendency in organic life. Thus consciousness must necessarily lead to an accentuation of the entropic or descending tendency, showing itself in decay or death. One is reminded here of the paradise legend distinguishing between the tree of life and the tree of knowledge and connecting the latter with death.

To the organic tissues of the body consciousness means death, which must be constantly counteracted by the organic activity in sleep. In the brain, then, we have an organ in which perfect functioning and perfect health do not coincide. While the health of the other organs may be measured by the perfectness of their functioning as parts of the organic totality of the body, the same cannot be said about the brain, because conscious psychic life—considered as the function of it—may be heightened at the cost of normal organic health without thereby having the character of disease. Normal organic health of the brain is no symptom of richness, agility and swiftness

of mind. On the contrary: such psychic qualities seem to be dependent on a certain lability and irritability of the brain and nervous system, which when reaching a certain degree is called nervousness or nervous weakness, because the organic health of the nerves is injured by it. Thus psychic and spiritual power may be connected with ill-health of the nervous system. We are told that Cæsar, Napoleon I and Frederick the Great were epileptics. Normal organic health of the nervous system seems rather to be connected with a certain slowness and dullness of mind than with alertness and delicacy of mental work.

The Nature of the Nerve-Process

We are of course here moving in a very hypothetical and obscure region. The crucial question in this domain turns upon the nature of the nerve-process, by which the brain or nervous system is made the basis of psychic life. But in spite of many theories science can as yet give no definite answer to the question. The nerve-process has been conceived by some as electrical, by others as chemical or even mechanical. But it seems now to be generally conceded that, though it is accompanied by electrical and chemical phenomena, it must in itself be essentially different from them. The theory of Johannes Müller, postulating a specific nerve-energy different for the various senses as underlying the special quality of their sensations, has largely been favoured by science. But when all facts of importance are taken into account, it seems necessary to consider the nerves as indifferent conductors of the nerve-process elicited by the sense-stimulus. And it seems impossible to make the nerve-process the productive cause of the sense-qualities.

Professor Ostwald sees in the nerve-process a mani-

festation of a special form of energy and identifies this energy with consciousness. In this way he places psychic life on a level with the physical forms of energy operating in inorganic nature, and the fact that psychic life is conditioned by the development of an organism really remains unexplained. From Ostwald's point of view the brain must be regarded as an apparatus for the transformation of physical energy into nerve-energy or consciousness. But the known facts do not support this view. Though the investigation of the consumption of energy in the brain is especially difficult, the experiments of Rubner and Atwater show at least that the physical energy absorbed by the organism is also given out by it, in so far as it is not temporarily taken hold of by the body. Nothing seems to suggest that either organic or psychic life is developed and maintained at the cost of *physical* energy.

The presence of " entelechy " in the organism as a working factor in its development is of course not admitted by the mechanistic school of physiology, but it is affirmed by the neo-vitalists, constantly gaining ground in the scientific world. It is, however, widely admitted that this entelechy cannot be placed on a level with physical forms of energy. It must be considered as something transcending the level of physical energy, but able to employ physical energy to realise its inherent plan or impulse. And it is, as we have seen, to this organic entelechy that the development of conscious life seems directly related.

Conscious psychic life is thus separated from the material or energetic processes of the body by the intermediary of entelechial vitality. And this makes it intelligible, that the ideas of consciousness normally have no *direct* influence on the material processes of the body, especially if the nerve-process consists of a sort of de-

composition, by which vital power, otherwise manifesting itself in organic growth, is liberated from this plasmatic activity and used for the conscious awareness of sense-qualities, ideas and presentations.

Organic and Psychic Organisation

We have spoken of the psychic power, by which associative reproduction is effected, as a time-power, because it implies a command of time inconsistent with the character of mere material, mechanical causality. By the power of the " psyche " the successive experiences are organised into a life-career, manifesting a certain character in relation to material and social surroundings, much in the same way as physical matter is organised by the vital power into a body, by which a certain form or figure is unfolded by means of successive organic time-phases.

In both cases the predominance of time shows itself in individualisation and relative independence of the surroundings, and the close connection between the psychic and organic power is reflected in the dependence of the psychic career upon the successive phases of organic life. The organisation of a subconscious physical subject-object is a basis for the organisation of a psychic, conscious subject-object, enormously widening the intercourse with the surrounding world which is possible to the organism in its physical capacity.

This general inner connection between organic and psychic life may be further accentuated by the fact that reproduction plays a prominent part in both spheres, the organic as well as the psychic. As association and memory mean psychic reproduction, renewing the contents of past experience in present consciousness, so vital or entelechial power means organic reproduction or the reproduction of cells and organic forms from germs.

And it is tempting to compare the cells as elements of organic life with the single experiences or presentations serving as the elements of psychic organisation. The difference between the two spheres may perhaps largely be derived from the difference of their material or elements —entelechial power reproducing material unities, while the associating power is reproducing ideas. It is not unusual in biology to speak of the memory of the cells. The eminent physiologist Professor E. Hering spoke of memory as " a general function of organic matter." What he had in view was especially the memory of the germ-cell supposed to produce the phenomena of heredity. But Richard Semon has worked out this idea in detail in his theory of the " mneme," which includes not only organic, but also psychic memory. In this theory, however, the difference between organic and psychic memory is not sufficiently considered. All mnemic processes are according to Semon physical processes, i.e. energetic changes in organic matter, and psychic memory is only the form in which the mnemic process of the brain is consciously experienced. The " engrams " of Semon can no more than other purely physiological theories make us understand how the organic substance as a purely material complex can serve as a depository of the multitude of impressions which are reproduced in psychic memory.

The part played by the physical processes of the brain in psychic life is difficult to understand in detail. But it is easily understood that entelechy adapting itself to the material sphere must work much slower than psychic life and confine itself to durable forms, while psychic consciousness can only for a very short time dwell upon a definite form or presentation. Conscious life is therefore characterised by a certain swiftness of change compared with organic life. The advan-

tage of this to consciousness is of course the possibility of rapid adaptation, necessary for beings moving about on earth. The transition from the organic to the psychic sphere is thus a transition from one periodicity to another, organic life realising itself slowly in the periods of childhood, youth, manhood and old age, reproduced in every organism developing along the line of organic descent, while the periodicity of psychic life shows itself rather in the alternation between waking and sleep. And if we are to believe H. Swoboda, the ideas or presentations of psychic life have an inherent tendency to return after an interval of twenty-three hours.

Organic life may be looked upon as an ideoplastic work by means of matter and motion, while the ideoplastic work of conscious imagination is liberated from the conditions of material and motional existence. In the case of regeneration in lower animals parts of the body removed from it are reproduced by the vital power. But when it is unable to do that, e.g. in man, it may perhaps be said to cause a sort of subconscious imaginative reproduction of the organ which is removed. At least, it is well known that an amputated arm is *felt*, as if it were still a part of the body. On the other hand, organs which have not yet become material parts of the body make themselves felt imaginatively, when, for instance, young deer try to butt with horns that have not grown out.

Another analogy showing the connection of organic and psychic life is to be found in the fact that the processes in both spheres may go in opposite directions. There is, as we have seen, in the organic sphere an ectropic tendency, showing itself in growth, integration, etc., and an entropic tendency, represented by disintegration and decay. The first tendency may be characterised as a concentration upwards, the other as a sinking downwards. In the psychic sphere the ectropic tendency

is seen in the organisation and integration gained by conscious attention and straining, while the entropic tendency shows itself in a certain dissolution and chaos following upon the slackening of waking consciousness. Association, thought, and purposeful action are as ectropic factors counteracted by opposite forces. So dissociation stands against association, and a multiplicity of "secondary personalities" against the one overruling and wakeful personality.

The Brain and Psychic Life

It may be asked, how from the point of view here suggested we are to look upon the localisation of psychic functions in the brain. Should not such localisation be superfluous, if the only function of the brain is to be a source of the power by which psychic processes are realised. This question overlooks the fact that in psychic life a multitude of psychic elements are organised, and that the connection of this multitude with the brain as a means of communication with the outer world is too close to permit the brain to remain homogeneous and indifferent to the psychic variety. This variety must *colour* the brain, as it were, though the specialisation which in this way is brought about *in the brain* may be very far from reflecting the *detailed* differentiation in the elements, processes and acts going on in the psychic sphere. In other words the specialisation of the brain may be *general* compared with the psychic specialisation. Though we cannot look upon a special part of the brain as *producing* special psychic elements, it may, as a basis of the power of being aware, by which they are subjectified and appropriated, be *associated* with and thus adapted to them in a way similar to that in which psychic elements are associated mutually. So a sort of magnetic attraction may be constituted be-

tween a special part of the brain and a special group of psychic elements. But this does not imply that every psychic detail or act is correlated with a corresponding specialised material process. And the way in which such correlation is pictured by many investigators is illustrative of the tendency to an unwarranted translation of subjective psychic experiences into physical movements.

It is true that it is possible in the cortex of the brain to mark out as on a map the places of irritation connected with definite sensations and movements. But the irritation awakened in such a place cannot be identified with the contents of the corresponding psychic experience. The specialisation by which the place is isolated from others can therefore only be a specialisation of the significance or *meaning* which an irritation in this place possesses for the psyche, as a link in the system of subconscious mechanisation by which conscious psychic life and its contents are adapting themselves to the processes in the body and especially in the outer world. In other words, the link connecting a definite place in the brain with a special psychic experience is itself of associative character, which does not exclude the possibility that it may be very strong. Isolated irritations, as by the movement of a single finger or the stimulation of a very small part of the sensual periphery, are exceptions in real life. A nerve-irritation is always associated with a multitude of other nerve-irritations so as to form a special mechanism in a comprehensive system of mechanisation. The "apractic" and "agnostic" disturbances show how unusual it is that a single part or centre in the brain is irritated without the irritation of other centres. A multifarious and shifting co-operation is constantly going on between the various centres.

So the analytical and disintegrative work of the various senses is counteracted by a synthesis in words, presentations and concepts. While the " thing " in the outer world is dissolved by the senses into impressions of sight, hearing, touch, smell, etc., these impressions are in the " psyche " fused into the unity of the concept intimately associated with a word and a variable presentative content. In this way the analysis serves the synthesis, in the same way as the disintegration of the words into letters is the best means to master the words as a multitude of shifting combinations. To explain this finely balanced co-operation between the psychic elements by means of a *physical* communication between the various elements seems a hopeless undertaking. Elements of colour and elements of sound cannot move along physical tracts from the centre of sight to the centre of hearing, and vice versa, as we move on a road in the physical world. And if they did, the localisation would be suspended. The part played by the differentiated physical basis must be comparatively subordinate to the conscious co-operative play presupposing the simultaneous presence of the psyche as the co-ordinating power in all the different centres. The swift production of new and dissolution of old connections going on in psychic life is something altogether different from the *fixed* way in which the co-operation of material organs goes on. Compared with the brain the work of the spinal cord, for instance, is much more fixed and mechanised.

Undoubtedly the true place of the brain and the nervous system in relation to the brain is best understood if we remember that the nervous system has to function as an intermediary, by means of which the psychic life with its multitude of elements is constantly adapting itself to the surrounding world. The conscious psychic processes are often described as if the " psyche " had to

do directly only with the material processes going on in the brain. But about these processes the " psyche " knows nothing itself, and if we are to be true to its *experience* we must say that the " psyche " consciously and directly only has to do with the surroundings as they present themselves to it in sensations, and that therefore the part played by the nervous system as a means of this psychic communication with the outer world is too subordinate, mechanised and subconscious to need conscious apprehension.

If this place of the nervous system as an intermediary is kept in mind, we shall take care not to form hypotheses by which the brain is over-specialised as a basis of psychic functioning, and we shall beware of considering the nervous system as a sort of miracle-worker producing from its own depths the qualitative contents of sensations and presentations, with which the conscious act of being aware in the subjectivations and the objectivations of psychic life is directly concerned. The facts of the case show that the specialisation of the brain-areas is not so absolute and definite as the specialisation of the outer organs of sense. And there is reason to allow the " psyche " a power within certain limits to adapt portions of the brain other than the normal to its needs.

Various investigators, for instance Wundt, have made weighty objections against the view that the different sense-qualities are produced by the corresponding centres or areas in the brain. The difference in structure presented by the cells belonging to the areas of hearing, smell and sight, and the difference of these areas from the motoric and other areas, is not so great that we are entitled to speak of " cells of sensation." The idea of a specific energy of sensation as the source of the sense-qualities has according to Wundt no sufficient foundation

in the facts, which only permit us to speak of an adaptation of the sense-elements to the stimuli.

We cannot enter into an exhaustive discussion of the problem of localisation. But the facts mentioned above should be sufficient to check the tendency to " introject " psychic life into the brain (to use a well-known expression of Avenarius), and the part played by the sense-organs and the brain will be seen to be one of indirect though necessary mediation. But the realisation of the point of view here suggested implies a distinguishing between the sense-objects and presentations as such and the becoming aware of them, by which they are connected mutually and with the subjective ability. And the natural consequence of it is to attribute to the sense-objects and presentational contents much more objectivity and independence of the subject than generally is the case. The essence of consciousness is seen to be, not the *creation* of objects and contents, but the becoming aware of and assimilation of them in such a way that they are transmuted into the a-dynamic picture-existence characteristic of the reproducible sphere and divested of the compulsory force inherent in reality—a process which is necessary if the subject is to be able to manage them spontaneously and freely.

The Brain and the Germ

The tendency to introject higher potencies and processes into physical matter and motion is prominent not only in respect to the brain, but also in respect to the germ, from which a new physical body is developed. As there is a tendency to look for all the causes of psychic life in the brain, so there is a tendency to look for all causes of organic development in the germ. But as the association of ideas cannot sufficiently be explained by

nervous processes, so the phenomena of heredity cannot sufficiently be explained by the conjunctions of sexual cells. It is impossible to picture or understand how a spatial coexistence of different "determinants" (Weismann) or material unities of structure in the germ-cell can be a sufficient cause of a protracted succession of phases appearing in the continual development of the organism.

As spatial the structure of the germ is something ready-made and complete. But the organism is at the outset of its development nothing complete. It can only be realised in a series of successive states. The part played by time—or the differentiation of coherent successive phases—is here of such a nature, that it cannot be understood from the point of view represented by purely spatial arrangements and movements. It demands a transcendence above space by means of time and makes it necessary to supplement the spatial actuality in the germ with superspatial potentialities, inhering in an imaginative idea or type, constantly reproducing itself, with modifications, along the line of organic descent.

By calling this imaginative idea (of race or species) a potentiality we only lift it above the sphere of pure space and motion. And we are obliged to do so, because the inherent conditions of this sphere are not compatible with the qualities which this typical idea must have in order to explain the phenomena of racial heredity. No material structure can simultaneously hold suspended in itself qualities which, translated into the sphere of matter and motion, must unfold themselves in successive phases continually cohering, but mutually excluding each other. But such a form of existence must be attributed to the hereditary qualities, if the phenomena are to be explained. By motion you can only explain

purely mechanical effects. And it is because the sphere of motion demands a mutual exclusion of that which in the organic idea must be capable of a simultaneous existence, that we are obliged to transcend that sphere and postulate for this idea a form of existence making such exclusion unnecessary. What is contradictory in the sphere of space and motion need not be contradictory in the sphere of organic time. We know from our psychic life, how qualities excluding each other in the outer world can be kept suspended in the same idea. The concept " tree," for instance, has a form of existence in which an endless multitude of individual tree-qualities —which in the sphere of motion cannot coexist in the same tree, but must be distributed over a multitude of trees or over successive phases of the same tree—are united into a simultaneous whole by being considered as possibilities, not realities.

Thus organic development is essentially a manifestation of time-power, not of motional or mechanical energy, and the characteristic feature of this time-power may be seen in the union of qualities which in the material sphere must succeed each other or be distributed over different spaces. But while " entelechy " only shows its transcendence above space in its power to direct organic growth, psychic time-power in its turn transcends the sphere of organic growth, thereby gaining in inner potentiality and variability. And as the brain or nervous system is the material basis for the realisation of the conscious subject, so the fructified egg-cell may be considered as the material basis for the realisation of the organic or subconscious subject, which, as the representative of will, may be looked upon as the opposite pole of the thinking subject realising itself by means of the nervous system. And we may form a *picture* of the relation between these two subjects—or aspects of the

whole man—by imagining the thinking subject of the nervous system as growing from above downwards and the organic subject from the ground upwards, i.e. upwards from the line of organic descent, which through the germ-cells runs from parents to offspring. So we find in man a certain antagonistic reciprocity in the relation between the two subjects, a duality demanding constant equilibration. As the realisation of the conscious subject is conditioned by the psychic power which can be drawn from the brain, so the realisation of the organic subject—or entelechial idea—is conditioned by the energy which can be drawn from the germ-cells, when awakened to structural activity.

CHAPTER III

PSYCHIC LIFE AND SPACE

PSYCHIC LIFE AND THE SPHERE OF MOTION

It will be understood that we speak of four-dimensionality when we have to do with time as a ruling dimension in relation to space, i.e. when time is used for the explication of potencies by means of successive phases, which show an organic, not only a mechanic, coherence, and in relation to those potencies have a more or less pronounced *expressive* value. This always implies a certain self-movement in time, by which a definite course of time is singled out, as it were, within universal time-advancement and related to a subject as its individual life or career. In this way the various processes going on in time—whether they consist in material movements or in psychic acts—gain a coherent *meaning*, by which they are synthesised into individual wholes, which cannot be understood as indifferent parts of the universal coherence, presented by the sphere of mere motion. This transcendence above motion by means of time is in organic life connected with immanence in the motional processes. Every organism may be understood as a result of the immanent work of a four-dimensional potency in the sphere of motion. But at the same time the transcendence reveals itself in the fact that a definite part of the sphere of motion is individualised or subjectified, i.e. made a subject-object.

The *transcendent* relation to the sphere of motion implied in four-dimensionality is, however, realised in a more perfect way by consciousness, which, as we have

seen, is developed at the cost of the immanent relation. Consciousness is conditioned by transcendence above motion, i.e. by a *negation* of it. In every phenomenon of consciousness motion is ideally brought to a standstill, and the conscious perception of motion would itself be impossible if the perceiving subject were unable in itself to produce an ideal rest in relation to which the motion is perceived. Every act of perception or awareness is conditioned by such a rest, though it may have a very short duration. And the power by which it is brought about may be called time-power because it consists in a more or less pronounced commanding of time, a survey of it in a " now " which always has some extension in time, and by means of memory and expectation. This time-power then makes the subjective emancipation from the sphere of motion possible, and enables the subject in a greater or less degree to master the sphere of motion in cognition and action. It is true, as we have seen, that by sensation, which may be said to form the entrance into the sphere of consciousness, we are partaking in the processes of the sphere of motion, but only in so far as the sphere of motion itself may be said to partake in the conscious sphere, i.e. to present qualities and aspects transmutable into a psychic form of existence.

The transcendent and negative relation of conscious psychic life to the sphere of motion comes to light in various ways, e.g. in the fact that the moving about in the outer world is in greater or less degree made superfluous by the perfection of conscious psychic life. In sensation our experience is limited to our immediate surroundings. But this limitation is overcome by imagination, which has the ability by means of sensual material assimilated by sensations to picture any absent sense-object or sense-view. The more vivid and true

the imagination, the less necessity to move in space or travel to gain the knowledge desired. Kant seems to have had no desire to leave Königsberg, because his mind had a peculiar power by means of descriptions in books to realise very exactly the configuration of foreign countries and the life there. If imagination by some inner power should be able to replace the outer support which sensation has in the stimulus, it might even by a sort of active reconstruction "see" actual happenings in distant places.

Another effect of psychic transcendence is the fact that in the conscious sphere the relations of outer space are replaced by the subject-object relation and time. Space as a condition of motion is not to be found in the psychic sphere. Presentations have no mass—no measurable height, breadth or depth. And there are no measurable distances between them traversable by movement. The changes they undergo are changes in time showing themselves in variations of their contents and their relation to the subject. They may be differently related to the latter according to the clearness with which they are discerned, the facility with which they are accessible and manageable, and the coherence in which the subject becomes aware of them. Sensations or presentations, by which movements are imagined, are not themselves susceptible of movement.

Remarkable analogies may, however, be drawn between the psychic sphere and the sphere of motion. Thus the masses moved or moving about in the sphere of motion may be compared with the sensual objective contents of presentations, while the forces causing the movements in the outer world may be compared with the power of the subject to become aware, associate, discriminate and combine. Thus the duality of force and mass in the outer reality reappears in the psychic sphere as the

object-subject duality. The "masses" of the psychic sphere are the presentations. But these are not moved as are the masses in the sphere of motion, but only differently related to each other and to the subject. No distance can be said to separate the presentations from the subject who is aware of them. But the distances in the outer world, traversed by the moving masses, correspond to the degree of clearness with which the presentations or objective contents of the psychic sphere are discerned by the subject. In other words: nearness and farness of distance in the sphere of motion have their counterparts in the psychic sphere in the distinctness and indistinctness with which the subject is aware of the presentative contents, nearness corresponding to distinctness and farness to indistinctness.

Real motion is thus seen to be inextricably connected with mass, which in the physical sense of the word cannot be transmuted into a reproducible element of the psychic sphere. Sense-qualities such as colours, sound, etc., considered apart from mass do not move in space. It is only when mass is added to the sense-qualities that the changes characteristic of the reproducible psychic sphere must be replaced by real motion in space. The mere heaviness by which mass is represented *psychically* as an element of sensation leads to no real motion. A body does not fall to earth because it has the psychical property of heaviness, but because it in addition to this is a mass in the physical sense of the word, and because masses are subject to the law of gravitation. As an element of sensation heaviness has no pushing or moving power. It is only the subject of association, not of motion. Of course the *concept* of mass is an intellectual product belonging to a comparatively advanced stage of cognition. But on the other hand it has an experiential basis, which cannot be reasoned

away, in the relation of our own body to its sensual surroundings, and in the fact that this body as a centre of sensual experience must be moved about in space if certain sensations and experiences are to be obtained, while no such motion is inherently necessary to the realisation of imaginations and thoughts.

We may say, then, that the outer world to be transmutable into the psychic sphere must have not only mass and motion, but also *form*, if by this word we understand not only spatial figure but also sense-qualities. Only the form-aspect of the world of motion is assimilated by the " psyche " and transmuted into reproducible presentations and concepts, and it is only in so far as this form-aspect is common to the motional and psychic sphere that sensation means a conscious partaking of the events of the sphere of motion on the part of the subject. By virtue of its form every physical body is at the same time psychical, i.e. susceptible of sensation and sensually imaginable, a fact which shows the nature of the correlation between the psychical and physical world.

Objectivations in the outer world are objectivations by means of mass and motion, while the objectivations within the conscious psychic sphere are only objectivations of forms, i.e. sensual as well as intellectual forms. It is by virtue of this form-character that the reproducible elements of the psychic sphere up to the most abstract concepts are conceived, not as reality itself, but only as pictures containing a reference to reality. The so-called " intentionality " of presentations and concepts is a characteristic evidence of their detachment from reality. It is by limiting itself to the formal aspect of reality that consciousness is able to master it. Detached from the differentiations of mass and motion, sensual forms and elements are susceptible of the intellectual rationalisation going on in the psychic sphere.

Psychic Objectivations

If the only objectivations possible to the " psyche " consisted in sensations or sensual reproduction, the " psyche " would of course be powerless to master the detailed definiteness of the world of sense. But the sensual material is fused or absorbed into concepts or *forms of possibility*, by which a multitude of sensual forms is synthesised, and it is pre-eminently by means of these intellectual objectivations that the " psyche " gains the power to survey time and with it space. Sensual imagination is, however, indispensable to the realisation of this power, and in so far as the " psyche " has within its reach a sensual material, by which any sense-view in the outer world can be imagined (as the painter on his palette has all the colours necessary to paint any landscape or sensual body), the whole sensual world may be said to be four-dimensionally present to it as a possibility. But sensual imagination reflects the limitations of sensation : we can only perceive or imagine a limited sensual field in one moment, and the perception as well as the imagination of the various sense-views involved in real experience must therefore be distributed over a protracted time.

This limitation connected with the sensual objectivations of the " psyche " is, however, counteracted by its generalising power ; its ability by means of the intellectual forms of possibility to emancipate itself from the fetters of sensuality and its definiteness. The means by which consciousness is able to command space and time is pre-eminently generalisation, which is inextricably connected in a greater or less degree with *indefiniteness* as to sensual contents. General presentations or concepts have the character of limited spheres of possibilities, which—while mutually excluding each other—

leave room for a more or less wide range of disjunctive variations in the sense-objects, to which they are applied. And as these variations in the field of sense may mutually exclude each other, the definiteness demanded by sensuality can only be realised by leaving to sensation or sensual imagination to make those definitions for which room is left open by the concepts as such. By the concept "leaf," for instance, an indefinite variety of possible colours and forms is limited, all of which cannot be realised in one sensual leaf or in the same leaf at the same time. So the form of possibility permits—within certain limits—a fusion or amalgamation of qualities, which in the world of sense (or the sphere of motion) exclude each other.

But this necessarily implies sensual indefiniteness, and the products of thought are therefore characterised by a greater or less degree of unsensuality, the form of possibility implying the accentuation of unsensual *relations* at the cost of sensual qualities. This indefiniteness may, however, be regarded as a condition of consciousness, because it makes it possible to put *questions* to the field of sense, and—as we have seen in another connection—consciousness is dependent on the possibility of a questioning attitude to reality, leaving room for disjunctive experiences, which may or may not satisfy the wish of the subject. Thus the advantage of sensual, compared with the intellectual objectivations, is *definiteness* excluding a multitude of disjunctive possibilities, but having the disadvantage of unconsciousness as to inner coherence and causality, which can only come to light by a co-operation between sensual and intellectual objectivations.

Another characteristic of the products of thought implied in the form of possibility is a certain timelessness or "formal eternity," which is especially prominent in

mathematical and logical objectivations. The concepts of thought are indifferent or neutral to the special space and time in which the contents, to which they are applied, are really experienced. Therefore they seem unaffected by the changes of real experience and float, as it were, as abiding possibilities above the space and time of reality, ready to be applied to the various experiences when they appear. By this "formal eternity" the subject is made independent of "real" space and time. We may say that four-dimensionally it has present to itself as an "eternal now" the essence of that which is experienced in the limited space called "here" and the limited time called "now." The innumerable "heres" and "nows" of experience are constantly related to an abiding, or shall we say eternal? here and now of mathematical and logical possibility.

Possibility and reality are correlative, and without possibility there could be no consciousness of reality. So the forms of possibility serve the objectivation and determination of reality. Objectivation means rationalisation, by which the object is given a definite place in a continuity universally valid at least for a community of subjects. Foremost among such continuities of rationalisation are space and time, because the meaning of reality may be defined as the occupation or filling of a special place and time within universal space and time. But the consciousness of this universal space and time of reality is dependent on the subjective possession of space and time as forms of possibility, i.e. as purely formal objectivations, which have no existence outside the psychic, subjective sphere, but nevertheless are universally valid for the community of subjects.

Such formal objectivations within the subjective sphere are, however, dependent on a preceding *subjectivation*, by which an originally given objective continuity is

broken up into a subjective discontinuity yielding the material for the formal objectivation in question. So the sensually given space and time are by subjectivation broken up into discontinuous elements of association serving as material for conceptual objectivations. For associative memory the space- and time-coherence of the sensual world has become discontinuous. It can jump from one space or time to another. In a sense it has as many spaces and times as it has presentations, because the latter are detached from the space- and time-continuity perceived by sensation. In this way material is assimilated by which space and time can be realised as a mere *possibility*, in contradistinction to the reality revealed by sensation.

On the whole it may be said that objective continuities are broken up and made discontinuous by subjectivation, preparing the way for *formal* objectivations different in kind and belonging to different levels of abstraction. So the elements of association subjectified by a breaking up of the spatial continuity of the outer world are in the subjective sphere objectified by means of another form of continuity : similarity as distinct from dissimilarity. The objective continuity of space and time permits the coexistence and succession of very dissimilar objects, which by means of the formal objectivation of the subjective sphere are arranged in classes and species according to their inner similarity. What is continuous in the world of space and time is thus made discontinuous in the world of concepts, and vice versa.

It will easily be understood that mathematics and logic are sciences by which forms of possibility are objectified in necessary continuities of statements. What come to light by these objectivations are the inner limits of the forms of possibility in question, manifesting themselves as necessity. Thus the inner nature and

limits of space as a form of possibility are objectified in geometry, while arithmetic objectifies the necessity implied in numbers. In kinematics, dealing with motion, time is added to space as a condition of objectivation. Logic belongs to a stage or level of objectivation farther removed from the space and time of reality than mathematics. Its material is suppositions, the necessary implications and relations of which are objectified. In all these objectivations a rationalising synthetic principle is working together with an analytical disintegrating principle, which in relation to the necessary coherence and continuity of objectivation represents an element of subjectivation and irrationalisation. In all objectivations an irrational discontinuity is, as it were, overcome and smoothened by means of some necessary coherence or continuity. But the subject itself is never exhausted in such rationalisations. It floats above them, always ready to break them up analytically, retaining within itself the power to think *against* the laws of mathematics and logic. The reason for this is surely to be found in the fact that the deeper strata of the subject, feeling and will, contain something which evades rational objectivation.

There is an antagonistic relation between the sensual and the purely intellectual objectivations of the psyche, but they are correlative to each other. We shall not here discuss the relation between sense and intellect. Suffice it to say, that sensual material is reduced to a vehicle by the objectivation of intellectual forms, while the latter—especially space and time—are implied as a vehicle by the objectivation of sensual phenomena. In geometry, for instance, the sensual figures on the board play a secondary part as a means to illustrate the laws. They are reduced to a vehicle. On the other hand, when sensual colours are perceived or imagined, the

space in which they appear or their spatial figure is of secondary importance. It is reduced to a vehicle of the colour or its appearance. Intellect cannot wholly emancipate itself from sensual phenomenality, but is constantly using the latter as a vehicle, while sensual phenomenality is realised by means of hidden intellectual relations, that need not come to consciousness.

The Perspective Sense-perceptions and the Correction of them by intellectual Intuition

The primary objectivation of concepts or forms of possibility is brought about by active awareness or intuition, and—as we have seen in another connection—the form of possibility which is susceptible of the most perfect objectivation is space. Of course space is only gradually and by means of scientific investigations—especially those of geometry—objectified as a purely intellectual form. But a limited explication of it is always involved in the cognitive assimilation of surrounding reality and the active adaptation to it. The objectivation of time is dependent on the development of a consciousness of the present as distinct from past and future. By the consciousness of these three aspects of time the self distinguishes itself from them, and time is thus objectified as succession. But just because this succession is an objectivation, the self is not swallowed up by it. It is constantly excluding itself from the successive links—past, present and future—by comparing them, and by this exclusion it draws itself back into an unconscious timelessness. Consciously it lives in time, but only by relating past, present and future to the continuity of the self in its time-transcending existence, which is not illuminated by consciousness, but *from* which the succession in time and extension in space is illuminated.

The abiding self, to which the succession in time is related, must be understood as an object of intuition, not of passive, sensual awareness. We may call the self of sense perspectivic. It is the self as it *shows* itself here in space and now in time, limited by the perspectivic view, which this here and now implies. But the self of intuition is transcendent in the sense that it unites all the heres and nows traversed in experience in the wholeness of the personality and its biography. In other words, by the self of intuition the perspectivic limitations of the self of sense are overcome in more or less degree. The here and now of sense are taken up into an intelligible coherence as a note in a melody.

On the whole we may characterise the functioning of active awareness or intuition as a constant correction of the perspectivic limitations of passive sense-awareness. By intuition sense-perception is supplemented by those factors and points of view which are necessary to give it a place in an objective continuity or coherence, the validity of which is considered to be independent of the individual subject. And if sense-perception is to be a basis of such corrections, it cannot be looked upon as an *addition* to reality or a purely subjective product. On this conception of sensation no real cognition can be based. On the contrary: sense-perception must be understood as brought about by a *subtraction* from reality of all that which—owing to the conditions of this form of awareness—cannot be included in it. In sense-perception all the higher aspects and dimensions of reality are, as it were, unconsciously extinguished, and this is the reason for its perspectivic limitations. Within these limits it is true. It shows us reality as far as its presentative contents go, but only as it must present itself, when it is reduced by the extinction of deeper and wider connections. Thus the task of active awareness

will be to transcend the limits of sense by supplementing and correcting the sense-perceptions with those aspects of reality which are excluded by the very conditions of sense-awareness.

By *active* awareness, then—explicating itself in thinking—we neutralise the perspectivic character of sensation by absorbing the sensual contents into larger and deeper wholes. What is shown to us in sense from the outside we grasp by intuition more or less from the inside. So by passive and active awareness we grasp reality from opposite sides, as it were, and cognition grows by a constant correlation of these two sides. The conditions of cognition do not permit a simultaneous awareness of reality in all its aspects and its inner coherence. Therefore reality is by consciousness split up into halves or correlates, which must supplement each other in conscious cognition. But while passive awareness is something naturally given, active awareness is more or less dependent on the efforts of the subject. It may vary in development, penetration, or in comprehensive and delicate adjustment.

So while the space of sense is perspectivic, the space of intuition is geometric, and the limitations of perspectivic space are overcome by means of space intuitively grasped. The various perspectivic space-perceptions are the sensuous basis from which the mathematic space-intuition is developed by consciousness, and when this is done—in greater or less degree—the perspectivic sense-view is considered accidental and subjective. It is *deduced* from the mathematic as the true and objective view. And it may be said that the space-intuition of mathematics shows us the inside of that which is presented to us from the outside in sense-perception—of course not the material or qualitative inside, but only the formal. The inner necessary relations of space are

revealed and made conscious to us by the constructive work of mathematics with space-intuition, and the clearness of these relations explains the tendency to interpret all phenomena in the terms of space and mathematics.

And it holds good about time as well as space, that it is perspectivic in the form in which the subject originally becomes aware of it. We look back into the past and forwards into the future from the present moment, which is undergoing a constant displacement from the present into the past. This perspectivic view of time is overcome by intuition in a way similar to the overcoming of the perspectivic space-perception. The single or individual perspectivic time-views are considered subjective. The past, present and future as they are given to the individual subject are included in a wider progress, and the process of time is objectified in the chronological order of history. From this objective time-order the perspectivic time-view of the individual —or even the individual time-career—may then be deduced much in the same way as the perspectivic space is deduced from the space of mathematics.

But this objectivation of the time-order is only possible by means of the objectified space. Time is measured by means of the periodic movements in space of the celestial bodies or the hands of a watch, etc.

Sensual and Formal Space

From the foregoing it will be understood that the objectivation of space as a form of possibility is intimately connected with the objectivation of real or physical space, as distinct from the perspectivic illusions inherent in sensual phenomenality. It is only by philosophical reflection that we are induced to distinguish between formal and physical space, though in the case of

Einstein's theory physical facts have led to this distinction.

We may make this evident by realising the essential steps involved in the conscious objectivation of the "world-space." The starting-point or basis for the development of this idea must of course be the space of sense and bodily movement, in short those aspects of our psychic life by which we are partaking in the world of motion as different from the psychic sphere of reproduction, imagination and thought. The sphere of motion is at first only present to us as the immediate surroundings, which we are able to see, hear, smell and touch, and in relation to which we are able to change our own place by bodily motion. In this space of immediate experience my body is always the centre, and the surroundings are perspectivic in relation to it. The space occupied by my body as the seat of my self-feeling and power of self-movement is therefore always opposed to the surrounding space as the objective sphere, filled with the sense-objects among which I constantly move about.

So we find within the sensual space a correlation between the subjective and an objective space, and by means of self-movement an adaptation is constantly going on between the two, resulting in some form of equilibrium between the movements of the body—impelled by impulses and desires—and the sense-objects of the surroundings. But it may be said, that this equilibrium is constantly broken, on the subjective side by desires (e.g. hunger) craving for particular sense-objects, which are sought by movements, and on the objective side by sense-objects threatening the peace or even the life of the subject. The characteristic feature of a life which is limited to the sphere of sense and motion may thus be seen in a mutual adaptation between movement and sensation—movement being constantly controlled by

sensation and sensation by movement. By this adaptation the perspectivic or illusive character of sensual space may in some measure be overcome by *instinct*, so far as it is possible without the development of an *active* psychic life in memory, imagination and thought.

But in a subject limited to this space of immediate experience no consciousness of a world-space can arise. This consciousness is only possible when the subject is able to transcend the sphere of motion and sense altogether by means of self-movement in the psychic sphere. To understand the nature of this transcendence we must remember that it is possible to *live* in the subjective space of the body without the ability wholly to objectify it, i.e. to place it ideally on the objective side of the dividing-line between subject and object. This is obviously the general position of animals. They are not able to objectify their own body—to raise themselves above it by means of presentation and thought and look down upon it as an object on a level with other objects in the sphere of sense and motion.

On the other hand, man is able by developing spontaneous mental activity (or what we have called self-movement in the sphere of time) to neutralise the subjectivity of *bodily* space and look down upon the *whole* sphere of motion (and sense)—*the body included*—as a coherent objective sphere related only to the psychic subject of imagination and thought. A consequence of this is, that the opposition in the relation of the subjective body to its sensual surroundings is effaced. The subjective space of the body is by objectivation made *continuous* with the surrounding space. Both are fused into one spatial whole. Instead of a subjective space A differentiated from and opposed to an objective space B, we get a space in which A and B may replace each other without affecting the space as such. It is *indifferent*

to the space thus conceived, whether it is occupied by the body of the subject or some object of its surroundings.

Thus the development of active imagination and thought is connected with the ability to abstract from the subjectivity of the body and from the perspectivity involved in its subjective centrality. And by this abstraction the objectivation of space as an indifferent form of possibility is made possible. And it goes without saying, that *sensual* space by the same imagination and thought is widened outwards in all directions owing to the ability of the subject to imagine surroundings, which are not sensually present to it, and to localise them more or less correctly in space. But this widening of space does not cease with the surroundings, of which the subject has definite knowledge. Where this knowledge ends, the widening is continued by means of *empty* space, i.e. by space as a *form of possibility*. Empty space may be taken as expressive of the fact that where no definite object can be perceived or imagined, the subject can only objectify the spatial *form* as a condition of definite perception or imagination.

The consciousness of the world-space is thus seen to be a result of an intimate co-operation between sensual experience and mental activity, which when operating independently of sensual experience is the source of geometry or mathematics. But though this world-space to a superficial consideration may seem to be a homogeneous whole, an important difference in its relation to the subject comes to light according as it is considered in relation to sensual experience and movement (that is *to the body*) or in relation to active imagination and thought, by which the subjectivity of the body is neutralised and effaced. In the first case I am myself as a body an inhabitant of the world-space, being always at the centre of it and looking at it under the laws of

perspective. And in this case the infinity of the world-space may be considered as expressive of the fact that from the place momentarily occupied by my body I can move outwards in all directions and constantly gain new sensual experience by this motion—a possibility to which no definite limits can be set. In the last case I place myself ideally outside the world-space altogether and look down upon it as an object, within which my own body has no central significance, but is placed on a level with other bodies. In other words I am considering the world-space, not in relation to a spatial, but to an unspatial subject, or rather to a subject able to produce space by imagination and therefore also able to dissolve the continuity of the objective world-space into the discontinuity of images or ideas ruled only by the continuity of time. In one case the space is empiric, in the other it is ideal; in one case sensual, in the other *a priori*. In one case the tendency is to fill it with concrete sensual experience, in the other case to empty it of all qualitative contents and consider it only as a quantitative vessel. Our relation to space is a dualistic one placing us *within* it as a sensual and moving subject, but raising us above it by ideal abstraction.

Thus space is considered from opposite sides as it were—as perspectivic or as geometric—according as the point of view is shifted from the spatial to the unspatial subject. The effect of this is an antinomy in the relation of space to the subject. Space, which we learn to know by sensual experience, must precede the existence of the individual, because the formation of the body presupposes the existence of the space in which it is formed. But *a priori* space is a constructive product of the subject, which therefore as the producer must precede the product, and cannot itself be spatial in the sense in which the body is so. While the subject as sensual only is

able to centralise itself in a body occupying a diminutive part of the whole sensual space, it is, as *a priori*, able to produce the whole world-space.

The solution of this antinomy must of course be sought in the relation between the sensual (spatial) and the thinking (unspatial) subject, i.e. the subject in so far as it is partaking of the sphere of motion and its laws, and the subject in so far as it psychically transcends this sphere, retaining as a constructive form of possibility the space which in the sphere of motion is a condition of existence. The shifting of the point of view from one subject to the other, or the interpenetration of the two points of view going on in the interpretation of experience, are conditions making it possible to the subject to become conscious of the inner structure of space, in which it otherwise would live unconsciously. It is on the whole an essential feature of all formal objectivation or abstraction, that it is conditioned by a power to look away from the subjective and therefore perspectivic or accidental impression, making it possible for intuition to look upon the thing from an objective point of view by which the subjectivity of the impression is neutralised.

In the space-theory of Kant this relation between empiric and *a priori* space is neglected or left indefinite. From his point of view there is in reality only an *a priori*, and not any sensual, space. Consequently he cannot explain the fact that our sensual experiences are always related to a bodily centre *within* that world-space (or sensual space), which according to his theory is only an *a priori* product of the subject. There is obviously in Kant's theory no basis for the subjectivation and spatial preference of that bodily centre in relation to all other centres in space. If space *only* exists as an *a priori* formation of the subject, we should expect that the subject would be aware of the contents of sensual ex-

perience in a multitude of different points or centres in space at the same time. Why does the subject *individualise* itself *within* that space which is its own *a priori* product? Why do not its sensual and its *a priori* or formal presence in space coincide? In the spatial world of Kant there should be no reason for the subject to *move about* to gain new sensual experience. Kant reasons as though the spatially limited subject of sensation and movement did not exist. For him the subject of imagination and thought should be sufficient. Therefore the opposition in the relationship of the two subjects to reality does not come to light.

To the subject of sensation and movement the elements of objectivity, by which reality is experienced, are the sense-qualities, while space as such, though implied in sensual experience, may rather be called an element of subjectivity, in which the subject unconsciously lives. But to the subject of imagination and thought the element of objectivity is space, while the sense-qualities —or the sensual material of imagination—have here lost their objective significance. The sensual pictures of imagination are only subjective and cannot as such replace real sensations. But the inner structure of space is developed as a form of possibility by constructive mental activity as something necessary, universally valid and therefore objective. Thus the subject by transcending sensual space (or the sphere of motion) gains the remarkable power of ideal or *formal* omnipresence in space. It is no longer limited to the subjective perspective space of the body and its surroundings, but floats, as it were, over the space of the sensual world as a whole or penetrates it through and through with the consciousness of geometric (euclidic) necessity, which is coextensive with space.

By this pure space-intuition the subject becomes con-

scious of something which is identical in subject and object and unaffected by the changes in the relation between the two, because conditioning the existence and the activity of both, though presenting itself in different connections. Owing to this identity and universality space cannot be an object of sensation, by which the accidental particulars in space are discerned. It must enter consciousness in another way, viz. by the opposite connections in which it shows itself in the object and the subject. So space is the same though in opposite connections in the sensations and the movements of the body, the first representing objectivity and the latter subjectivity within sensual space. And it is the same though in opposite connection in the outer world-space and the imaginative space of mental activity, the first presenting it as an objective continuity and the latter, as we have seen, as a subjective discontinuity of various images. By this sameness in opposite spheres or connections the identical, changeless and indifferent universality of space comes to light, and the space-intuition becomes like a mirror, which to reflect the various forms and colours itself must be formless and colourless. To apprehend such a universal conditioning aspect of reality, the subject must on the one hand enter it, live in it and partake in it as something preceding its existence in that sphere. But on the other hand it must also assimilate it into its own self-activity, making it an autonomous point of view, the implications of which are mastered constructively in all directions.

It will easily be understood that the formal objectivation of time must be perfectly analogous to that of space : in what we may call " sensual time " consciousness is as it were subjectivised and centralised in the present, as against the past and future. The essential feature of this sensual time-view is the *content* of experi-

ence, and from the standpoint of the *present* content the relation between past, present and future cannot be looked upon as *indifferent*. But when the subjectivity and perspectivity of the present is neutralised by abstraction, the attention is attracted by the fact that the past has been present, and that the future will become so. From this point of view, then, it is indifferent to the moment as such or as a part of time whether it is future, present or past, and the stream of time is looked upon as *uniform*. It is objectified as a form of possibility, from which the subjective, accidental or perspectivic point of view is eliminated.

The development of the intuitions of space and time as pure forms of possibility is so intimately connected with and dependent on sensual experience, that abstract space and time are constantly confounded with real or physical space and time as distinct from the perspectivic or sensual. But a little reflection will make it evident that the space and time of reality or the sphere of motion cannot have all the characteristics of formal space and time. The formality of the latter consists in their perfect *indifference* as to any real content, and such indifference is impossible as a reality. It is only realised in thought by a *negation* of reality by means of pure possibility. Thus formal space and time only have the character of *pictures*, with which consciousness can operate. They are devoid of causality in the real world, as the picture in a mirror may be regarded as incausal in relation to the mirror and the rays reflecting themselves in it. As perfectly *a-dynamic* formal space and time can only have a psychic and no real existence, the reality of which inherently is dynamic.

This negative relation of formal space and time to reality comes to light in the perfect *emptiness*, attributed to them. Such emptiness—a perfect "nothing"—is

impossible as reality. "Empty space" can only have a relative significance as applied to the outer world. It can only mean a spatial reality, within which single bodies can move comparatively freely. The perfect emptiness attributed to formal space and time is only expressive of their ideal abstractness: the demand of thought to consider them apart from all content *only* as forms of possibility. But in this form they have an indefiniteness inconsistent with outer reality and only consistent with psychic or conscious realisation. Reality means *definition* in space and time, which implies a limitation of the freedom contained in the pure form of possibility. The indifference of formal space, for instance, means that it gives the utmost freedom of spatial constructive possibility. But this freedom is necessarily limited by the definitions implied in physical realisations. The cognition of reality is negatively conditioned by formal space and time. But as such negative conditions they are not themselves contained in *real* space and time in the same way as special realities or things are contained in them. They are only forms of possibility appearing where physical reality ends and psychical objectivation begins.

In accordance with the philosophy of Kant space and time are often as sensual forms distinguished from the intellectual forms represented by the "categories." But there is little reason to make this distinction a fundamental one. Space and time are objectified as forms of possibility by intellectual intuition much in the same way as the categories, and we may even in the works of Kant find symptoms which show that he was puzzled by the fact that numbers as the material of arithmetic offer characteristics very similar to those which induced him to expel space and time from the domain of intellectual forms, within which he had place

for the numbers. We shall not discuss the expedients by which he tried to evade this difficulty, but only accentuate the fact that the relation of the mathematician to geometric space is the same as his relation to numbers. It is that of intellectual intuition to its objects. The system of numbers is necessary, timeless and objective in exactly the same sense as space and time. And we may say about the numbers as Kant says about space and time, that they are not a general concept, having the special concepts *below* it, but a singular (or concrete) concept, *in* which the special numbers are *contained*. The relation of numbers to other numbers is not that of subsumption, but that which holds good between a whole and its necessary parts.

CHAPTER IV

SPACE AND PHYSICAL REALITY

FORMAL AND REAL SPACE

SENSUAL space must, as we have seen, be distinguished from formal and from physical space, and if it is asked, what makes physical space different from formal, the answer must be: its dynamical character. Physical space must be considered as a dynamic definition, by which a selection of possibilities, contained in formal space, are realised. Euclidic space taken as a pure form of possibility contains an infinite multitude of possibilities, of which all those are excluded which do not agree with the qualitative and therefore dynamic reality in question, whether we have to do with the universe as a totality or with a single individualised reality within it. Besides the spatial possibilities realised in the physical world a multitude of other possibilities are thinkable and constructively imaginable.

This will become evident when we remember that the physical laws are essentially different from the laws of geometry. In geometry the magnitude of the figure is irrelevant to the law illustrated by it. The geometric triangle or circle may be enlarged or diminished without altering the laws, that the sum of the angles in the first is 2R, or that the circumference of the latter is $2pi\ r$. But in real space it is otherwise. If the magnitude of a physical body is diminished or enlarged, essential changes will appear in its constitution and its relation to other bodies. It is sometimes said that if the magnitude of *all* physical bodies were enlarged, diminished or

deformed equally, the change could not be observed by us, because the spatial relation of our own body to its surroundings would remain unaltered. But in this supposition we look upon the physical world exclusively from a geometric, a-dynamic point of view without taking the physical or dynamic relations into consideration. If the change were only geometric without a corresponding change of the dynamic relations, the physical world would be thrown into chaos. Thus the supposition that no change would be observed by us implies that not only the magnitudes or form of the bodies, but also the natural laws expressing their constitution and interrelations, would be changed. In other words: by looking upon the physical world from an exclusively spatial or geometric point of view we neglect its essential physical nature, i.e. those dynamic definitions by which magnitude, form and distances are specified and a multitude of other spatial possibilities are excluded. By every supposition of spatial deformations the euclidic formal space and its possibilities are retained as a basis for comparison, and we demand a special dynamic *cause* as an explanation of every deviation from it.

We see, then, that in geometry the sphere in which the material unities and their dynamic interrelations are essential is transcended, and the sense-qualities, by means of which their specific nature is ascertained in the world of experience, are in geometry reduced to a mere secondary vehicle for the constructive operations of thought, by which the inner limits of the spatial possibilities are explicated.

This geometric transcendence above the sphere of mass and motion, to which we are related by sensual experience, is also illustrated by the fact that the ideal figures and relations of geometry are only approximately

realisable in the world of sensual experience. This fact might be elaborately illustrated. In the sensual world we find no triangle or circle in which the demand for mathematical exactness is realised. From the standpoint of mathematics they can only be considered as approximations to the exact circle and triangle. In other words: the material of geometry allows an idealisation or rationalisation which in the physical world seems to be impossible. Physical quantities can only approximately be defined and measured. And the consequence of this is, that the natural laws must be considered approximate in a corresponding degree. The exactness of physical relations can only be tested by ideal unities and numbers, which in the physical world are only imperfectly realisable. Of course, the grave mistakes connected with the original perspectivic views of the senses are gradually eliminated by measurements and mathematical calculations in a degree which is sufficient, perhaps more than sufficient, for practical purposes. But this practical exactness is insufficient for the mathematical ideal. Thus in the natural laws nature is made known to us not exactly, but only approximately as it is.

Distances in space are only very vaguely perceived by sensual experience. But the vagueness of sensual perception is purified by the intellectual development of measure and number. And the so-called "pure," but empty intuition of space is a result of such purification, being the continuity correlated to the subjective discontinuity of the unities of measurement and the numbers by which they are represented. But the power of presentative imagination is transcended by the intellect. Very long and very short distances we cannot judge presentatively, but only define mathematically, e.g. the light-year of astronomers or the wave-length of the

Röntgen-rays (10^{-9} cm.). The presentative power is thus supplemented by the constructive acts of interpolation or extrapolation.

There is no reason to give discontinuity a primary place and make space (and time) a composition of discontinual elements, as for instance is done by *Mach*. Continuity and discontinuity appear together in the field of perception, and in the space of mathematics the continuity of pure space-intuition is a presupposition of the discontinual unities of measurement and numbers, which as subjectively manageable may be considered as the result of an analytical disintegration and purification of a sensually given or presupposed continuity. It is true that the keen analysis of physiologists has led to a discrimination between various " physiological spaces ": a " space of vision," a " space of touch," etc. These physiological spaces may not directly be identical with geometric space. Various differences are pointed out by psychological analysis. But they are susceptible of unification by geometric space. We shall not here discuss the nativist or empiricist theory about the origin of sensual and presentative space, but only accentuate the fact that the dissonances of physiological space or spaces are harmonised by geometric space. Of course the awareness of the latter belongs to a comparatively late stage in cognition, but as the being aware of an object is not identical with its creation, the place of space in the order of existence cannot be determined by its place in the order of cognition.

By passing from the formal space of geometry to the physical space ideal possibilities of the former are excluded by specifications, but the possibilities of formal space are applicable to the physical as a means of rationalisation. By shifting the point of view from the constructive sphere of geometry to the experiential sphere

of the senses, we are able to compare the real space with the possibilities and the necessities of the formal, and the fact that it is possible by geometric means to rationalise sensual experience shows that the nature of euclidic space is realised, at least approximately, in the physical universe. By the development of geometry we gain a point of view outside the sensual or physical world, and by means of the ideal possibilities of geometry and the inner rational limits of them apprehended as *objective necessities*, we are able to put *questions* to sensual experience and ascertain how far reality corresponds to these necessities and which of the various geometric possibilities are realised in it. The means by which this comparison between real and formal space is accomplished is measurement and mathematical calculations. The unity of measurement is a mediator between formal space and its possibilities and the actualities of real space. Therefore it has a double face, one turning inwards to the constructive sphere of mathematics and the other turning outwards to sensual experience. In the first capacity it is used as a means of construction, in the last capacity as a means of perception. We use the metre not only to measure the bodies of space as we find them, but also to give the bodies which we construct predetermined geometric dimensions. And the worth of the unity of measurement lies in the contrast between these two applications of it. When used as a means of perception it excludes from reality a multitude of possibilities, that might have been realised by it as a means of construction. It was this contrast between formal and real space which induced the great mathematician Gausz to measure the triangle Inselsberg–Hohenhagen–Brocken in real space to ascertain how far the mathematical necessity of ideal space, that the sum of the angles in the triangle is 2R, holds good in

the world of experience. He found that the outer reality with approximate exactness corresponds to the mathematical necessity.

Various objections may be raised against this view. On the one hand it may be said from an *a priori* point of view, e.g. that of Kant, by whom space and time are made *a priori* forms of sense-perception, that sensual experience is too much an (unconscious) *a priori* product of our own creative activity to do duty as a means of confirming the objective validity of formal space. On the other hand it might from an empiricist point of view be urged that geometry is developed from sensual experience and therefore cannot give us a really objective point of view independent of that experience. But the full scope of the difference between sensual experience and formal intuition is under-estimated by both these objections. The *a priori* point of view cannot explain the specifications contained in the spatial forms of the sense-objects, while to empiricism the creative or synthetic function of formal intuition remains unexplained.

It must be remembered that, though sensual material is used as a basis or rather as a vehicle for mathematical constructions, its relation to the latter is fundamentally different from the part played by it in sensual experience. To be used as a vehicle for mathematical constructions it cannot remain in its original state, but must be purified or idealised, as it were, by thought. Therefore pure space-intuition, presentatively realised, is something very different from space as it is experienced by the senses. And the intellectual operations by which this idealisation is effected are, as we have seen, not limited to extensions, which may be imagined by means of such extenuated sensual material, but transcend it enormously by mathematical interpolations and extrapolations. If the sensual material were not common to

both spheres, though in opposite connections, no comparison would be possible. On the other hand, the very power to put *questions* to sensual experience implies a standpoint of real independence in relation to it so far as the question goes, because it implies the ability by ideal means to realise possibilities independently of sensual actualities. The wide range of these possibilities as developed by thought, compared with the limitations and definitions afforded by experience, is sufficient to show that the two spheres of cognition, though mutually dependent on each other, are different enough to serve as a mutual means of corroboration.

Formal space is not a vague mixture or fusion of different sense-qualities, but rather a synthetic scheme by which the contradictions between the different sensual phenomena are overcome. Thus sensual experience and its qualities cannot produce geometric space, but only *give occasion to* the production of it. Of course one sense may be more important than another as a basis of that production. But this does not alter the fact that the development of geometric space implies a metamorphosis of the sensual material. The geometric space is not identical with the visual space, the space of touch or the space of kinæsthetic sensations. It has been pointed out, that optic space (or the appearances involved in the perspectivic view) would lead to the metageometry of *Riemann*, not to euclidic geometry. In optic space all straight lines—when sufficiently prolonged—revert to themselves (e.g. the line of the horizon), and if I look at the angles in my own room they all appear obtuse. The sum of the angles, represented by the rectangle of floor and roof, would therefore be more than 4R. In other words the optic space is " spheric," not euclidic, and if we were not able to move about in space—or to correlate optic sensations with sensations of movement—

the contradictions between the various perspectivic views which are eliminated by geometric means would remain undetected. *Heymans* has tried to identify geometric space with that of kinæsthetic sensations. But though optic sensations are not necessary to the development of the consciousness of geometric space (geometric propositions are quite intelligible to persons who are born blind), the qualities of kinæsthetic sensations cannot be said in their original state to give us geometric space with its three dimensions. They need correlation with other senses, by which sight to some degree can be replaced, e.g. touch, and they need at least a purification, by which they are reduced to a mere *vehicle* of the real space-intuition. This purification is the essential point showing the activity of a principle, by which the limits of the sensual material as such and the contradictions connected with its various views or aspects are transcended.

Formal Space and the Metageometries

But there is another objection of more importance. It may be said that the validity of euclidic geometry in real space cannot be determined with certainty by measurement, because the unit of measurement—e.g. the metre—itself belongs to the physical world (as we do ourselves in our capacity of material bodies), and together with the physical world in its totality, ourselves included, might change in such a way from place to place that the deviations from euclidic space could not be detected. In this connection it must be remembered that the extent to which measurements can be undertaken in the sensual world is limited. By means of mathematical calculations we are in a certain sense ideally omnipresent in space, but our sensations and movements

cannot keep pace with this omnipresence. The extension of the sun may be calculated, but cannot be measured by a march around it, and the calculations in question are based upon several presuppositions—for instance, that the unit of measurement can be transported unchanged from place to place. Thus the calculations are based upon formal space as a means of rationalisation. To this must be added the fact mentioned above, that it is impossible in the world of sense to reach the degree of exactitude characteristic of the world of mathematics.

It must be admitted that the very nature of sensual experience makes it impossible to verify with absolute certainty the implications of formal space in the physical world. But as the impossibility of detecting deviations from it would imply a physical or dynamic teleology *aiming* at the production of rational illusions, the assumption of it would mean going very far beyond the limits of reasonable scepticism. So long as it is possible by mathematical calculations, based upon the validity of formal euclidic space, to predict experiences in the world of sense, the overwhelming probability is in favour of the conformity of the real to formal space. And hitherto science has had no cause to doubt this conformity. But certain physical facts have of late led Einstein to base his theory of relativity upon the supposition that reality deviates from formal euclidic space, which may be exact enough for practical purposes, but fails when cosmic distances and differences of motion are taken into consideration.

This has resulted in renewed interest in the so-called "metageometries," based upon presuppositions at variance with euclidic space, and their relation to reality as well as to formal space is earnestly discussed. As is well known, a geometry logically consistent in itself has

been worked out by Lobatschewsky and others, based upon the presupposition that a number of parallels to a given straight line can be drawn to a point outside it, and that the sum of the angles in a triangle is less than 2R. The space appearing as a consequence of such a geometry has—compared with the uniform equality of euclidic space—a negative measure of curvature. That is to say: it would in euclidic space be represented by a "saddle-formed" plane, which may be considered as the opposite of a sphere, because the two main curvatures of it turn their convex sides to each other. On the other hand: Riemann has worked out a metageometry in which, not only the parallel-axiom of Euclid, but also the euclidic presupposition that only one straight line can be drawn between two points, is given up. The space resulting from this geometry has a positive measure of curvature and is called spheric, as against the pseudospheric space of Lobatschewsky, because it is found that the metageometric propositions of Riemann correspond to the usual spheric geometry with this difference only, that its propositions are applied to a space of three dimensions, not to a two-dimensional surface of a sphere. In this way space becomes spheric: it reverts into itself and is "unlimited," though not "infinite." While euclidic space represents an equal uniformity or a measure of curvature $= 0$, we have thus on the one hand a negative, on the other a positive deviation from it, and according to Einstein the world-space has a slight positive measure of curvature, which might be compared with the physical plane of the Earth, upon which we live. If the distance from gravitating masses is long, the world-space has a tendency to become perfectly euclidic. But in the vicinity of gravitating masses, it has a curvature which corresponds to the gravitative force of the masses in question.

There can be no doubt that these metageometries, by making presuppositions at variance with the pure intuition of space, leave the domain of *formal* space altogether. They may be logically consistent in themselves. But as such they are only examples of logically coherent objectivations of the intellect, which are to be judged not only in respect of their inner logical consistency but also in respect of the presuppositions they make. And as these presuppositions contradict space-intuition, their inner logic is not that of formal space, whatever else it may be said to explicate logically. The true logic of formal space is euclidic geometry. It may be impossible to *prove* the validity of Euclid's parallel-axiom [1]; but it is perfectly intelligible to space-intuition, which must be allowed supreme power to decide in all matters of formal space. By referring the difficulty to a fourth dimension of space, which intuitionally is unrealisable

[1] We may as to the true place of the parallel-postulate in geometry refer to a treatise by Professor Kr. Kroman, *Mathematics and the Theory of Science*, an acute investigation into the nature of geometry as a purely *formal*, not real science. The apparently negative results of the attempts to prove the parallel-postulate are there shown to be due to a tendency to look upon the objects of geometry as " mystical " objects, having a reality of their own apart from the definitions by which they are created. That is to say, geometry is confounded with a real science. The fact that the objects of geometry constructively are created by definitions is rightly emphasised in this treatise. While the definitions of geometry precede the objects, they must in real science adapt themselves to the objects as found in experience and thus succeed them.

If this really is kept in mind the scepticism as to the proofs of the parallel-postulate will be seen to be unfounded, the problem being dependent upon the definition of the straight line as a line the direction of which everywhere is the same. The origin of the metageometries is in this connection clearly shown to be due to the tendency to confound formal with real science.

The more the creating capacity of geometric definitions as purely formal is kept in mind, the more it will be evident that the objects in physical reality in *so far* as they correspond to geometric definitions must be taken as a result of dynamic definitions as different from formal ones.

and unintelligible, it is not overcome, but only hidden. That a fourth dimension can be symbolised by numerical values in analogy with the three dimensions is no justification of its spatial character, and the similes used to justify it are all taken from three-dimensional space, the implications of which are presupposed but set aside when the fourth dimension is to be asserted.

We may know much or little about real physical space, but about formal space we have a knowledge of universal and necessary validity, because it is an intellectual intuition, the implications of which are apprehended by means of our constructive definitions. But there is a tendency to deprive the space-intuition of its legitimate place as a form of rationalisation beside the pure logical form, because the relation between the two is in some way felt to be dualistic. The dualism is, however, only that which is implied in the relation between a wider and a more narrow field of possibility—the logical sphere of objectivation leaving open possibilities which in the sphere of formal space are excluded by definition and limitation. It may of course have its advantages to deduce the propositions of geometry logically from original axioms or presuppositions, and David Hilbert is especially named as a mathematician who has almost wholly succeeded in this attempt to raise geometry to the sphere of pure logic. But in this, as in many other cases, it is only possible in greater or less degree to veil the fact that the fundamental concepts of geometry *have passed through* the intermediary stage of space-intuition and cannot be detached from it.

Take for instance the fundamental concept of equality or congruence. The logical correlate of this concept is identity, and we may look upon the congruence of geometry as the identity of logic transformed into the medium of pure space-intuition. Without the latter it

is impossible to introduce identity into geometry and apply it to sensual experience. It must be remembered that no *principle of multiplication* is inherent in logical concepts as such. The logical concept is a unit and cannot as such exist in many identical copies. The concept of causality, for instance, is a unit, and a multitude of identical or congruent concepts of causality is an absurdity. So the concept of identity *itself* remains a unit within the pure logical sphere. But when applied to the space-intuition it is multiplied by the latter into an endless multitude of identical units of measurement: metres, cubic metres (and in the case of time: hours, minutes, etc.), the exact mathematical equality of which is realised by space-intuition, not by sensual experience. By the multiplicity of these exact space- (and time-) units sensual experience is worked into formal space, which as an intuitionally presupposed objective continuum is the exact correlate of the discontinuity represented by the units of measurement. So space-intuition is necessary to the *multiplication* of the logical ideal of identity into the *exact* units of measurement. Of course this does not mean that space-intuition is obliged to follow the intellect in all its mathematical calculations and logical operations. But its necessary mediation is made evident.

The conception of space and time implied in the theory of Einstein has met with much opposition, especially from Kantian philosophy. But the well-known representative of Neo-Kantianism, Cassirer, has found reason to modify the *teachings* of Kant, though upholding his transcendental *method*. He detaches metrics from space-intuition and interprets the latter to mean the universal law of juxtaposition, in so far as it is involved in the metageometry of Riemann, which permits certain relations of continuity and coherence. In other words:

in place of pure space-intuition we get a concept, general enough to include not only euclidic geometry, but also the metageometries, and by which the choice of metrics is left open. In this way, however, the synthetic a-priority and universal necessity of space-intuition is given up.

But there is no reason to abandon this necessity and a-priority, if its negative, a-dynamic formality is really kept in mind, and if formal space is not endowed with a qualitative and dynamic function which is perfectly foreign to it. In sensual experience, by which we partake in the processes of reality, the determining factor is not formal space or space-intuition, but the qualitative content, expressing and forming the dynamic nature of reality. But in the intellectual operations, by which space-intuition is developed, all qualitative elements corresponding to dynamic specifications in nature are eliminated, and the space, whose nature is objectified in euclidic geometry, is therefore *perfectly a-dynamic* and as a consequence of this also necessarily *unreal*, because all reality must be dynamic. In other words, its formality implies the negation of physical reality. As a *pure* form it can only have an *abstract* existence as an idea or as an ideal of consciousness opposite, but correlative to the reality, of which consciousness partakes by sensual experience.

But this abstract form is no *arbitrary* idea of consciousness. On the contrary: consciousness partakes by this idea in an objective, universal necessity, but a necessity which has the peculiarity that it is perfectly *conditional*, not causative. That is to say, formal space does not involve the *existence* of a real or physical space. It is perfectly indifferent to the question of existence or non-existence—a pure form of *possibility*—and its inherent necessity is therefore independent of realisation

or non-realisation. The only meaning of this necessity is, that *if* spatial realisation takes place it cannot break the necessity of formal space, but must *specify* possibilities involved in it.

Owing to this a-dynamic character of formal space, it is *perfectly impotent* causally. It can never legitimately be considered either as cause or as effect. It is " eternally valid " whether a real space exists or not, and the realisation of such an outer space is dependent upon a *dynamic* cause, not contained in formal space as such. This eternal, but purely negative and unreal necessity is a peculiarity of all logical forms, which therefore can only be realised and apprehended consciously by *free insight*. By the perfect elimination of all dynamic coercive factors free insight is made possible, in which all dynamic activity is on the side of the subject.

If this negative relation of formal to real space is kept in mind, we can approve of the words of Einstein, when he says that in so far as the propositions of mathematics are necessary, they do not refer to reality. But it is a consequence of this our conception of formal space, that all apparent deviations from it, which might be detected in reality by the aid of sensual experience, must have a dynamic cause and be attributed to the dynamic nature of reality. They cannot be explained by attributing to physical reality another space-form than that of the mind, because no other space-*form* than the euclidic is possible. But much confusion as to this question is caused by the fact that real is constantly confounded with formal space, and that the relation of formal space to dynamic nature is not clearly realised.

It is not difficult to understand that, if real space can only be real by virtue of a dynamic specification and definition of formal space, the perfect *indifference*

implied in the a-dynamic and non-causal character of the latter cannot be realised absolutely in the physical world. It is *only* in formal space that it can be perfectly indifferent to an object (or geometric figure) whether it is transported from one place to another. In the physical world (and in the psychical as well, when we consider the single *acts* going on in it) we never pass outside the causative, dynamic domain, even when we have to do with the uniform continuity by which the spatial extension of the world is maintained, and it must be supposed that this last or inmost physical continuity as well as the less comprehensive continuities realised within its extensive domain can only approximately realise the spatial uniformity of euclidic space. As we shall see later on: the dynamic character of reality appears in *motion* and its differentiation, and motion represents in relation to formal space an element of irrationality, which resists perfect rationalisation.

The mistake, then, involved in a metageometric interpretation of reality is, that this element of irrationality is introduced into the very forms of rationalisation and made formal instead of dynamical. The result of this is, that formal aspects of existence contrary to their very nature are treated as if they were causal and dynamic and could produce special qualities and spatial changes. In so far as the metageometries deal with spatial continuities (or "manifolds"), the latter are in reality only to be considered as specifications of possibilities involved in euclidic formal space, and they should as such be attributed to a dynamic cause—whether it be the constructive definitions or acts of thought or a physical force—not to a form, the formality of which is indissolubly connected with its non-causality.

To understand this we must remember that formal euclidic space represents the utmost *freedom* of spatial

possibility thinkable, and that a fourth dimension cannot widen this freedom *spatially*. But this freedom of motion and form inherent in euclidic space is veiled by the mathematical language, speaking of the three dimensions of space as if the freedom of spatial *possibility* were limited by them, while the truth is that they only function as a *means of orientation* to spatial *limitations* and *definitions*, which may be infinite in number and variety. Space as such is not extended in three directions or three main directions, but in *all possible* directions, the number of which is also infinite. This is easily forgotten. But when it is remembered, it cannot surprise us that the metageometries in reality lead to limitations of the spatial freedom of euclidic space, that is to say, to spatial formations *within* space. As Lotze, Wundt, and many other critics have pointed out, the illusion connected with metageometric speculations, that they introduce us into a new spatial world, with new attributes, is a result of the fiction that it is permissible to deal with formations *in* space as if they were space itself, or to endow space itself with attributes which can only belong to spatially defined formations. It must not be forgotten, that in every spatial specification, formation or construction, formal space itself is implied as the background or rather presupposition, making it possible.

That the euclidic freedom of constructive variability is limited in the metageometries is shown by the fact that quantitative relativity is destroyed by them. In their spaces it is impossible to construct a triangle corresponding exactly to a given triangle, but on a reduced or enlarged scale, because the magnitude of the angles is dependent on the absolute length of the sides. But it is evident that a space, in which large or small has an absolute sense, is no longer the formal extension itself,

but a formation within it. Helmholtz himself has pointed out that it is impossible for a body belonging to euclidic space to be transported into a curved space without being stretched or pressed.

Science is naturally very closely bound up with mathematics, and hitherto mathematics has been a means to overcome the perspectivic appearances of sensual experiences by means of space and time. But in the theory of relativity it serves for the perspectivation of space and time. It is necessary, however, to distinguish carefully between the mathematical and the dynamic point of view. In natural science there is a tendency to prefer mathematical *descriptions* of phenomena to a dynamical explanation of them, and this tendency has in the metageometries and the four-dimensional " world " of Minkowski found a welcome means of operation. But to evade the causal or dynamic point of view is not easy, and if the limitations of the mathematical point of view are not kept in mind—the fact that we can only speak of reality where we have to do with causal or dynamic processes—a confusion will easily arise, by which mathematical formulas produce dynamic effects or vice versa. In the theory of relativity we have the feeling that we have entered a field which in some way is miraculous, just because formal conditions are treated as if they were causal forces. Space and time appear like magicians, when, for instance, a metre is shortened or lengthened by its mere transference through a space which is considered as formal. In this case the presupposition is, that mere space can do what ordinarily must be done in a workshop or a forge, and there is no doubt that much of the interest of the public in the theory of relativity is due to these apparently miraculous consequences. The curving of space is in any case a causal process—whether it is done imaginatively or in

reality—presupposing euclidic space as a *formal* background of comparison and presupposing the transformation of space itself into a dynamic reality able to force a certain structure upon the spatial bodies. That the universe as a totality may be spheric and in so far correspond to the metageometric conclusions of Riemann, is another matter. This spheric character of the universe must then be due to a dynamic realisation of possibilities inherent in formal, but unreal euclidic space. It cannot be considered as a formal necessity, but as a *dynamic definition* by means of motion.

Besides the indifferent uniformity of formal space there are other attributes of the latter which cannot be transferred to real space, if the dynamic nature of reality is kept in mind, viz. : emptiness and infinity. Emptiness is only another expression for the a-dynamic character of formal space, a presupposition of the ideal geometric constructions. In physical reality there can be no empty space, because space here has no reality apart from material and dynamic definitions. Similarly in the psychic sphere formal space has no psychic reality apart from the mental functions, by which it imaginatively or intellectually is defined, though it gradually is apprehended as an uncreated objective presupposition involved in these functions.

That real space cannot be infinite may seem to be a more doubtful affair. But it will be understood that this is an inevitable consequence of the presupposition that dynamic realisation is identical with the specification of possibilities within formal space. Reality means definition, and definition means limitation. The difficulty connected with the concept of a finite universe is our apparent incapability to realise a limited material universe otherwise than as surrounded by "empty" space. But this incapability is mainly due to a natural

disposition to apply to the universe as a totality a point of view which only holds good by the comparison of parts *within* the universe. The physical universe can have no outer, but only an *inner* limit, *by which it is related not to an empty space outside it, but to life and consciousness.* And here we are confronted by the conception of the fourth dimension in the sense suggested by us in the foregoing parts of this treatise. It will be remembered that we have connected this fourth dimension with the relation between space and time, and that the consideration of space apart from time is only realisable by formal abstraction. Now time may as well as space be considered from a purely formal point of view, and in this case it is as a-dynamic as formal space. Formal time cannot "ravage." It cannot, any more than formal space, effect any real change. And to be real, time must be dynamically *defined.* In reality, where time and space are inextricably interwoven, time may, however, be considered as the aspect by which the dynamic nature of reality is especially realised. To apprehend the time-relations between objects or phenomena is pre-eminently to grasp the dynamic relations between them. In the "becoming" or the changes taking place in reality the dynamic element of reality is especially prominent. But to consider the dynamic relations between specialised or even mechanically isolated parts of the universe is very different from considering the "dynamis," by which the universe as a totality is limited, defined by space and time and maintained as a dynamically coherent reality. This "dynamis" cannot be found among special physical energies or forces. It must be a four-dimensional force in the sense that it connects the whole universe with an inner psychic sphere and separates the latter from it.

Surely the infinity of the universe belongs to the

spiritual, not to the physical part of it, and the infinity of empty space is only an empty shadow of the infinity of possibility belonging to spiritual existence. There is therefore no need to go to the end of the universe to find its boundaries. They are four-dimensionally to be found everywhere within the physical universe.

Consciousness and Life considered in the light of a Fourth Dimension

To understand how the idea of four-dimensionality may be of some help to the apprehension of consciousness and life, we may make the following reflections. We have seen in another connection that the consciousness of the lower dimensions of space is realised by means of an isolating abstraction. The consciousness of the first dimension (line) is realised by abstracting from the third and second dimension (cube and plane), and the consciousness of the second dimension (plane) by abstracting from the third (cube). Owing to this fact it is evident that when the abstract exclusion of the higher dimensions is suspended, it is possible to reach every point in an object of one or two dimensions *without passing through any point in the object itself*. By suspending the abstract limitation of my consciousness to the line, for instance, and the continuity of points by which the line is realised, I can arbitrarily set up a point outside the line in a plane with it, from which I can reach every point in the line *directly* without passing through the points in the line. Similarly, by suspending the abstraction from the third dimension I can set up a point outside the plane, from which every point in the plane can directly be reached. In analogy with this the reality of a fourth dimension would involve the ability to reach any point in a three-dimensional body (a cube) *directly* without

passing through any point of the cube itself. In physical space (or space imagined as physical) this is impossible, because there can be no fourth dimension of *space*. But notwithstanding this the idea underlying the search for a fourth dimension is of importance. We shall understand this if we ask: from what do we abstract, when we investigate the nature of imagined three-dimensional bodies in space? Of course we abstract from the investigating consciousness itself as a power of being aware, imagining, constructing and thinking. And by reflection we shall find that the claim put forward on behalf of the fourth dimension—the ability to reach directly any point within three-dimensional bodies—really is satisfied by this consciousness in the three-dimensional space of the pure space-intuition. As a part in outer space considered apart from the subject and its consciousness, a point within a three-dimensional body can only be reached by passing through other points in it. But considered as a purely mental object—a product of constructive imagination—constantly connected with the activity of the subject, the case is different. It cannot be denied that consciousness *ideally* is present in every point of such an imaginative construction, and can make any of these points the *starting-point* of further geometrical constructions. The ideal cubic body is, as it were, transparent not sensually, but intellectually. That is to say: it is penetrated through and through by the power of awareness belonging to consciousness, which therefore has the power to single out any point within it. Or we may say: in space as it is realised by the pure intellectual intuition we have not only to do with space as such but also with consciousness and its activity, which in itself is not spatial, and which therefore has the power *directly* to reach any point in the continuity of formal space. In the case

of ideal geometrical constructions the continuity of formal space is no obstacle separating consciousness from their starting-point.

In sensation, by which we partake in the sphere of motion, this "omnipresence in space"—if we may call it so—is not so conspicuous. But so far as it goes sensation is also characterised by an ideal penetration of that part of space which it reveals to us. It is, however, not so much in sensation as in association, imagination, memory and thought, that the real character of the psychic sphere—as different from the motional—appears. And by these forms of activity the inherent powers of the "psyche" are realised in a sort of *inner* space, penetrated by consciousness, in contradistinction to the outer space, by which the true nature of things is veiled. And in this inner space its true formal nature is objectified. By means of the sensations *we* live in space. But by virtue of our conscious inner activity space is *in us*. So the transcendence realised by conscious activity means a sort of *inversion in our relation to space*. By sensation we learn to know the *things in space*. By mental activity we learn to know *the space in the things*, gaining what we have called a power of omnipresence in formal space, by which geometrical constructions and definitions are made possible to us.

This inner and direct relation of consciousness to the objects of its activity—its four-dimensionality—may also in a modified form be attributed to life. If we remember that the life of an organism consists in its continuity and teleological unity—the harmonious co-operation of its different parts—life itself must be said to be directly present in every part and point of the organism. The various material particles or juices and energies must pass from point to point or part to part, but to life itself—the co-ordinating unifying power, as it appears re-

flected to the inner sense in self-feeling—every part seems directly accessible. It represents a continuity working within and by means of the discontinuity of the body. We need not here repeat what we have said before about the relation between consciousness and life. What is realised in consciousness as psychic transcendence appears in life as a subconscious directing immanence in the sphere of motion. *But in both cases a sort of four-dimensional continuity is actively realised within a discontinuity,* and we begin here to surmise that this relation may have cosmic significance.

Here we are, however, especially concerned in the conscious psychic life, and as the power of being aware in the first instance is kindled in sensation, we may look upon the latter as a mediator between the outer space of sensual experience and what we have called the inner space of mental activity. We may *picture* to ourselves the outer space as a large indefinite sphere and sensation as a point at the surface of it. This point of sensation would then be a point of contact between the outer space and the inner space of mental activity as well as a point of transition between them. And if we could place a pair of scales at this point, the one representing the outer and the other the inner space, we should find that the aim of the psychic activity is to make the scale of the inner space outweigh the scale of the outer. Or to use less pictorial language, we may say that the *real* order of the outer space and the *idea* of the inner are correlative, and the point of contact, or sensation, is a point by means of which they are mutually opposed to as well as transformed into each other, by subjectivation and objectivation. We may therefore compare the relation between the outer and the inner space with the relation between the yolk of an egg and the fructified cell in it. The mass of the yolk is outweighed by the

latter, though it is little more than a point, because it is able to transform the nourishment of the yolk into the living organism of the chicken. And in a transferred sense we may be said to devour outer space by the development of the inner, the latter giving us the power of orientation in the outer as the chicken develops the power to move in the outer world. As a means to correlate the outer and the inner space we might also at the point of contact between them (sensation) place a cross of co-ordinates, by which they are mutually referred to each other.

CHAPTER V

SIMULTANEITY AND RELATIVITY

SIMULTANEITY

TIME can, as we have seen, only be detached from space by isolating abstraction, and by the conscious realisation of formal space time functions as a subordinate *vehicle*, because it is presupposed that formal space remains unchanged through time. It is a remarkable feature in the conscious realisation of space that the whole of it —or *all* points in space—is embraced by *one* moment of time. No part of space can stand outside any "now" of time. And this "now" is not satisfied with the all of space. All non-spatial psychic processes going on contemporaneously are also included in it.

Thus time is implied in all conscious realisation of space and perception of spatial changes. And the intellectual synthesis of space or spatial reality as a unity is made by the idea of *simultaneity*. As formal space is conceived as a simultaneous unity or uniformity, so all objects and processes in the outer space are presentatively connected by the aid of this simultaneity involved in the *idea* of space. Contemporaneously with my writing in this room something is taking place in the streets, in the opposite part of the globe, in the sun and at the end of the universe. So we are able by means of the idea of simultaneity to *objectify* the spatial universe into one whole. Time—or rather the "now" of time—is thus seen to be a sort of Archimedean point, making it possible to consciousness to transcend ideally the whole spatial universe and realise a sort of formal intellectual omnipresence in it. To the idea of simultaneity as such,

motion—or the overcoming of spatial distance by motion —ceases to have any significance as a means to become conscious of spatial extension as a totality. To the intellectual objectification of simultaneity it is utterly indifferent whether I am in this or that place in the universe or whether I move in it with this or that velocity. So this idea implies an intellectual or ideal transcendence over the sphere of motion.

As is well known, this idea of simultaneity is undermined by the theory of relativity in its present form. From the standpoint of this theory there is no real or objective simultaneity apart from the observers and their state of motion in the universe. That is to say: time itself is swallowed up by the different states of motion in space. Thus no time or simultaneity seems left for the synthetisation of the whole space or universe. Two or more observers resting in relation to the earth and its motion may apply the idea of simultaneity to the same events. But if the one observer is stationed on earth and the other on Saturn, which is moving with another velocity in relation to the sun than to the earth, the idea of simultaneity must be applied by them to utterly different events.

The meaning of this is not that perspectivic displacements or deviations from the real order of time are caused by the difference of place and states of motion. Such perspective time-displacements, for instance, that of lightning and thunder, are constantly neutralised by reference to an objective time-order and the simultaneity which can be determined by it. But the possibility of such neutralisation by the aid of a common objective time-order is denied in the theory of relativity, when we have to do with different cosmic states of motion. Not only the perception of time, but the time-order itself, is perspectivised and limited to a certain area of the

universe, and no objective simultaneity can be made to include events belonging to two different cosmic orders of motion. It has been objected, that by such destruction of objective simultaneity the unity of nature cannot be maintained, as this unity is conditioned by a coherent objective order in time as well as space. In the theory of relativity the unity or uniformity of space and time is replaced by the mathematical formulas of transformation, which may be looked upon as representing the unity of law. The conditions for the objective application of the idea of simultaneity have therefore become an important question. But before it can be taken up in connection with Einstein's theory some preliminaries must be cleared up.

Perception of Motion

We have seen that formal time (analogously to formal space) may be regarded as produced by an intellectual purification of empiric time. The unity by which time is measured—hours, minutes, seconds, etc., are intellectual products, which by this purification have attained their exactness, and in this case the purification is conditioned by the mediation of space. While the geometric purification of empiric space is possible without taking time into consideration, space cannot be dispensed with as a basis for the intellectual purification of time. If the subjective time-perception is to be corrected by objective time, the latter must be fixed and made measurable by means of space. This is done by the spatial distances traversed by the hands of the watches. Thus space is a necessary intermediary to the exact mathematisation and objectivation of time.

We have further seen that spatial distances which transcend the power of presentation become manageable to the intellect by means of calculation. The same

holds good in the case of time. Thus time-orders or velocities of succession, of which the psyche can have no *direct* experience, can be made objects of *thought*. And in the capacity of *possible* time-orders or thought-objects they are indispensable as means by which real time-orders may be compared and judged.

Professor K. E. Baer has finely illustrated the effects of a hastening or delaying of the time-order inherent in human experience. The determining factor in this time-order will, as he points out, be the time, which we need to become conscious of a sensual impression. If this subjective time-measure is either shortened or lengthened, the appearance of the objective world, in which we live, will be fundamentally changed. Suppose that we were able in the same unit of time to perceive many more impressions than now, this unit of time would then be much "longer" to us, and we should have the same number of experiences in a much shorter time. There seems to be an inner connection between this time-order of subjective experience and the rhythm of our organism appearing in pulse and breathing. If, then, our pulse were a thousand times faster than now and we were able between two throbs of the pulse to perceive 6–10 impressions as now, we would in a month have as many experiences as we now have in a whole human life of 70 years. But to such a "month-man" the whole of nature would have another appearance. The sun would rise and set only 29–30 times in his whole life, and the moon would to him have the appearance of a disintegrating body, because in his old age he would see it constantly decrease as in his youth he had seen it increase. He would have no reason to believe in the return of the moon. If the experiences of a human life were concentrated in forty minutes, the consequences would be even more marvellous. In such a life the

shifting of day and night would be unknown. Grass, flowers and trees would have the appearance of unchangeable things.

On the other hand, if our pulse were a thousand times slower than now and the time needed for single experiences correspondingly increased, we should in a year only have the number of experiences which we now have in $8\frac{3}{4}$ hours. Then we should literally *see* the flowers and trees grow, the summer would last only four hours, and in this period the sun would finish its course in the sky in one minute, while it would be invisible for half a minute.

Of course the time-processes in the objective world might be hastened or delayed according to the changes in the time-order of human experience, and in that case no change would be observed by human consciousness. But this possibility is quite analogous to the possibility mentioned above of a geometric enlargement or reduction of the world. The physical nature of the world is dependent upon *definite* time-orders as well as upon definite spatial magnitudes, and a hastening or delaying of its time-orders is as little compatible with it as a geometric enlargement or reduction of its magnitudes. We need only remember the conditions of lighting a match to satisfy ourselves that a definite time-order is necessary to the realisation of certain physical effects. If we move the match too slowly, no fire will be produced. So the time-orders in physical nature are all definite, as is also the case with the time-order of human experience. And by the illustrations of Baer it is made evident that our subjective perceptive power is definitely related to certain rhythmical motions in physical nature, in the first instance to the rhythms of pulse and breathing, which may be supposed to be as definitely related or adapted to the rhythmical motions

of the earth around the sun. Thus we are as *sensual* beings immersed in a definite time-order determined by organic and cosmic rhythms. But intellectually or in the *abstract* we are able to transcend this limitation by the calculation of other time-orders and the consequences of them. As *possibilities* any other time-order than our own is intellectually realisable to our mind.

If we now consider our perception of motions in the outer world, it is a fact of importance that motion can only be perceived by means of an " absolute space," i.e. a resting or changeless spatial background. Of course the background in relation to which the movement is perceived may as a physical reality be in motion. But by the *appearance* of immutable rest it is perfectly fit to serve as " absolute space " for the time being. In this sense, then, the perception of all spatial changes or movements is conditioned by absolute space, whether it is considered an objective physical reality or not. We have no difficulty in conceiving the outer space unchanged from time to time, But if we are to perceive or sensually imagine a movement in it, it can only be done by means of " absolute space " in the form of a background remaining unchanged or apparently resting for the time being.

It will thus be understood that " absolute space " originally is the space which I am able to embrace sensually, and within which I move about. By means of imagination and thought and by the elimination of myself as a bodily centre of sensation and movement it is gradually neutralised and widened to comprise the whole world. But it may be considered present in the visual field, which we perceive in a moment, as well as in the physical world as a whole, when we try to realise it intellectually as an object independent of our cognitive powers.

" Absolute space " is thus seen to be an expression of the fact that by the process of cognition we try to work formal or intuitional space into the world which we learn to know by the outer sense. If therefore we place a fixed cross of co-ordinates in a momentary field of sensual perception, it may be said that by the process of cognition it is gradually moved outwards, as it were, from this starting-point in the sensual phenomenon and at last placed in the centre of the world, to which the immutability of the original sensual background then is transferred.

If we analyse the field of vision, e.g. considered as a starting-point of the process of cognition, our attention will probably be awakened by a colour " a " or a complex of colours within the changeless field " B–D." By this act of attention only the *place* of " a " within the spatial field of vision will be perceived. If " a " moves, this motion can only be perceived if it permits me to be aware of " a " at least twice, so that the place occupied by it in the one case is different in relation to the field of vision " B–D " than in the other. The field of vision (or " absolute space ") must remain unchanged, and " a " as such must also remain unchanged. The only change must be a change of place occupied by " a " in relation to " B–D." (We need not here consider the fact that from the standpoint of phenomenal or kinematic relativity we might as well consider " a " as fixed and " B–D " as moving. This is at all events not the natural standpoint in sensual perception, and it can only be realised by a process of objectivation transferring the original fixedness of " B–D " to " a.")

The primary condition for the perception of spatial motion is thus an unchanged background for the time being. Further, the change of place must be continual and discernible, and the *spatial* continuity of motion

must find its correlate in a *time*-continuity of the perceiving power. That is to say, I must retain in memory the places occupied by " a " in the succeeding moments of time and be able to compare them analytically as well as survey them synthetically as a unity. For instance, if I drew a line and in the continuation of it could only be conscious of the point momentarily occupied by the pencil, so that at every point the drawn parts of the line were forgotten, I should continually be at the starting-point of the line, and no line as a whole would be produced. Thus if the line is to be produced, the attention leading the act must be able to look backwards as well as forwards. And this condition will be valid, whether the line is drawn constructively by myself, or whether it is drawn by a sense-object in the field of vision. In the case of motion the part of the line traversed by the moving body is not sensually present as in the drawing of a line on paper. It can only be realised by memory.

Now it is an important fact, that the sensual perception of motion is conditioned by a *discrepancy* between the time of subjective perception and the time as objectified in the perceived motion. Within a time, which to the subjective sensual perception is a " now," the moving object is seen at different places. The consequence of this is, that if the motion were considered from the standpoint involved in the subjective perception, it would imply the contradiction of being at different places at the *same* time or in the same subjective " now." This contradiction is removed when it is remembered that time as realised by the successive " nows " of subjective perception is *different* from the time involved in the objective motion of the sense-object or point. What is the *same* time to the subjective standard of measurement must be different times

(or " nows ") to the objective standard of time-measurement, which would have to be applied to the motion.

Motion is thus only perceived sensually when an objective " before and after " is subjectively included in the same " now " or synthesised in a succession of " nows," surveyable by memory and intelligence. It is evident that if there were no such discrepancy between subjective and objective time, or between the time of the subjective act of perception and time *considered as a function of the moving sense-object,* no motion could be perceived at all. Thus time as a *spatial* function is something different from time as a function of the perceiving mind, and it is obvious enough that " absolute space " or the changeless background is a medium by which the " now " of the perceiving mind is subdivided into a number of successive " nows " corresponding to the different *places* (or points) occupied by the moving sense-object during its motion. It will easily be understood that this discrepancy between subjective and objective time in the perception of motion has something to do with the famous paradoxes of Zeno, according to which motion is unreal, because it involves the contradiction of being at two or more places at the same time. In fact the solution of the difficulty pointed out by Zeno is to be found in the discrepancy here elucidated, or more generally in the fact that every time-order, whether psychological or motional, must be perceived as a succession of " nows," and that every " now " to be realisable psychically must have an extension in time, which may be disintegrated by means of space. Motion as sensually perceived or imagined is not an analytical process by which space is divided and subdivided into different points, but on the contrary a synthetic process, by which a spatial coherence is perceived by means of the enduring psychical " now " and its

continuation backwards and forwards in memory and expectation. This problem shall not here further detain us. It should, however, be remembered that the psychical " now " has been shown by experimental psychology to vary between minimum and maximum limits of time, the minimum time representing the shortest duration which a process must have in order to be perceived, while the maximum time represents the longest duration which a succession of impressions can have and yet be perceived as one " now."

It will be understood from the foregoing that " absolute space " not only—as a changeless background—is a means to perceive motion, but also a means to divide and subdivide analytically the time of the motion by connecting it with the divisibility of the distance traversed. Thus velocities of motion, which are too slow or too rapid to be perceptible sensually, become mathematically or intellectually realisable. But " absolute space," whether it is realised in a sensual field of perception or in the formal space of intellectual intuition, is in reality a spatial *simultaneity*, by which every motion is transcended. It means a simultaneous presence in a more or less extended spatial area—psychically or ideally realised—and in relation to this simultaneous presence motion is perceived or calculated. For a *simultaneous* presence in space there is no need for motion as a means to realise the presence in its different parts. It is only when a simultaneous presence is unrealisable that there is place for motion as an instrument to be present in different parts of space in different times. This simultaneous presence is of course only imperfectly realised by the psyche in physical space. In the formal space of intellectual intuition it is perfect. But the fact that it is realised to some extent even in a momentary sensual perception shows that it is needed as a foil, as it were,

to the conscious realisation of all changes taking place in the sphere of motion. It is the medium by which the whole sphere of motion is objectified and related to the perceptive power of the mind. In other words, it is the very stepping-stone of transcendence from the sphere of motion into the psychic sphere.

Of course the velocities of motion which can be perceived sensually are limited. If the motion is too slow it is mistaken for rest, and if it is too fast an appearance of rest may also occur, e.g. when a circle of fire is produced by swinging a piece of glowing coal. But sensual perception is supplemented by the instruments of science and by mathematical calculations. The presupposition is, however, in all cases a simultaneous space as a foil for the realisation of all possible velocities of motion, because these are to be found between two extremes, both of which lie outside the domain of motion or velocity altogether. The one extreme may be formulated thus $\frac{0 \text{ space}}{\infty \text{ time}}$ and the other thus $\frac{\infty \text{ space}}{0 \text{ time}}$. As the meaning of the first formula is that every spatial point remains unchanged through an endless time, it may be understood as an expression of a changeless space. In so far it may be taken as identical with the last formula, the meaning of which is that no time is needed to realise an endless space. At all events both these formulas lead us altogether out of the sphere of motion into the sphere of an ideal spatial simultaneity, transcendent in relation to very *concrete* movement, but needed in some form or degree to make the conscious realisation of different movements *possible*. By this spatial simultaneity every slowness is transcended on the one hand by the insignificance of time in relation to space and every rapidity on the other by the insignificance of space in relation to time.

Space and Subject

It may be said that the part played by space in relation to physical changes and motions is played by the subject in relation to psychical changes. As the immutability of space is necessary for the perception and comparison of motions or physical changes, so the immutability of the subject is necessary for the perception and comparison of psychical changes. Space and the subject are, as we have seen, correlative to each other, the one as a condition of objectivation, the other as a condition of subjectivation. And both have a meeting-place or borderland, as it were, in every sense-perception, where, as we have seen, the discrepancy appears between the time of subjective perception and the time of the objective motion, leading on the one hand to subjectivation by inclusion in memory and on the other to objectivation in outer space. Obviously the time of the motion is perceived and objectified by means of its difference from the time of the perceptive function, which is identified with the subject. If no change or movement is observed in the field of vision, this spatial immutability can only be perceived and realised by its contrast to the subjective changes of time on the part of the perceptive power, which is obliged to discriminate between different "nows" succeeding each other, in which the spatial field remains unchanged. In this case, then, the immutability will be objectified, while the changes are subjectified. But in the case of spatial changes, they are, as we have seen, judged in relation to a consciously realised simultaneous spatial *presence*.

It will be understood from the foregoing that simultaneity is something different in relation to the spatial world from what it is in relation to the subject. In relation to the spatial world it is a means by which the

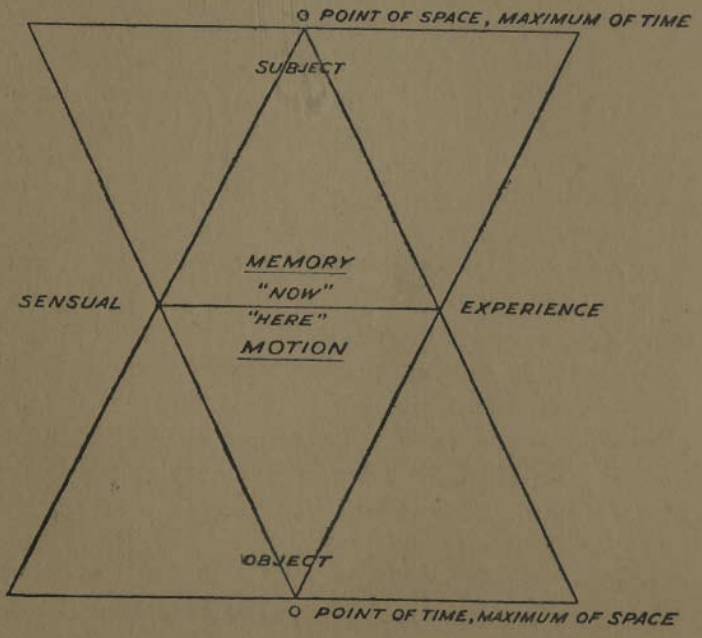
various movements or changes in different parts of space are related to and compared with each other, and the tendency will here be to determine the simultaneity by the impossibility of spatial change, because change of place implies difference of time and is incompatible with real simultaneity. The ideal in this case will therefore be to survey the momentary positions of all points in space in a fraction of time *so small* that no change of place is possible in it, even by a movement of the highest velocity. The unity of time, by which simultaneity is realised, will be reduced in the direction of 0, in order if possible to bring all the movements in the universe to such a momentary standstill as is necessary in order to obtain a simultaneous snapshot of them. Of course a perfect realisation of such an ideal is impossible, and this leaves room for a certain imperfection or irrationality in the application of *ideal* simultaneity to the *real* world.

Considered in relation to the subject simultaneity is detached from its determination by the possibility or impossibility of spatial change. Its meaning is now perceived or experienced together or at the same time. That is to say, it is a means to the realisation of *memory* by discriminating the present from the past and the future. The tendency will therefore be to *include* in the "now" of experience all that can be perceived or experienced in that now. The simultaneity of experience or memory will therefore have an extension in time, which may be considered enormous in relation to the motional simultaneity. And it is evident that the now of experience has no exact or definite limits. It is continually connected with the past as well as the future, and the survey of time aimed at in the simultaneity of present experience is widened by memory and expectation in both directions.

So the ideal here will be to overcome time (or we

might also say : to bring it to a standstill), not by reducing it to a minimum, but by permitting it to expand into a maximum, which is surveyed in the first instance by memory and further by the timeless generality of concepts, making it possible in a certain sense to look upon the changes in time from the standpoint of "*an eternal now.*" It is evident, however, that the realisation of this "eternal now" by human consciousness is imperfect, though in another sense than the realisation of the simultaneity of the motions by space. And it must be remembered that to the ideal functions of consciousness here considered space loses its significance and therefore may be looked upon as reduced to a minimum.

We may therefore illustrate this interesting correlation between space and time by the following figure :



In sensual experience the two spheres—the psychic and the motional—penetrate each other like the two triangles in the figure, but only in a limited degree producing the "now" of time and the "here" of space (simultaneous presence), by which sensual experience is characterised. This "here" is by the objectivation of cognition widened below to the maximum of space or world-space, while the "now" or simultaneity, considered as a function of motion, is reduced to the 0-point. On the other hand the same "now" considered as a function of experience is widened above to a maximum of time or world-time, surveyed in the first instance by memory, then by presentations and concepts, while the "here" of sensual experience—or the space as limited by sensation—in relation to the cognitive functions of the subject loses its significance and therefore may be regarded as gradually reduced to the 0-point. That the two spheres are correlative and interdependent has been shown in so many connections that there is no need to emphasise it here.

But in the figure above, which in the first instance is meant as an illustration of the idea of simultaneity, all aspects of the correlation between the two spheres do not appear, especially because the space of the sphere of motion only is represented by one moment, in which all motion is ideally brought to a standstill. In so far the *motional* aspect of this sphere, by means of which it endures in time as a coherent system of incessant coherent changes, is veiled. It is evident that the dynamical character of the sphere of motion is conditioned by time, but that the innumerable spatial changes brought about by it cannot be synthesised or rationalised into one simultaneity. They are therefore counterbalanced in the psychic sphere by means of a system of intellectual *forms*—presentative, mathematical and

logical—in which not the detailed actualities, but only the possibilities of the sphere of motion are mirrored, and by which the time in the sphere of motion as realised in motions and spatial changes is overcome.

But it must be remembered that the present moment is sufficient to exhaust the whole of space (or the field of motion), and that past and future cannot in any moment of time be really found in space, because the whole panorama of the spatial world, if we were able to survey it, could only show us the *momentary* motional situation as a transition from a different situation in the past to a different situation in the future. The present motional situation may of course be considered as continually or even causally connected with the motional situations of the past and future, but it cannot be said spatially to *contain* them, because it is a peculiarity of spatial difference as displayed by motion that the different motional situations, succeeding each other, cannot be preserved within or by space. As the continuity of motion is a purely spatial one, it excludes every memory and therefore the past and future also. We can therefore only find past and future by transcending beyond space to the psychic sphere, where the spatial continuity is dissolved and replaced by continuities of presentative, mathematical and logical nature, and where the *motional* simultaneity of the moment is replaced by a *conceptual* simultaneity embracing all time. The apparently contradictory problem to reproduce the past and anticipate the future can therefore only be solved by a superspatial psychic activity, and there is reason to say that the psychic sphere is enormously more extended than the whole of space, because it contains mirrored in memory and anticipation what has been in space or will be there, but is absent from it in the present.

Past and future may, however, be said to enter the

sphere of motion, when the *same* motions are repeated from time to time with regular intervals, so that they are reduced to being means by which certain *forms* are realised. By such regularity *material duration* is produced. But this implies a time-power, which in relation to motion as such has the prerogative of a higher dimension. It has the character of direction and intentionality and leads to the conception of *life*, which—as we have seen—shows us this time-power unconsciously working in growth and reproduction, while consciousness shows it transformed into a medium of cognition and free activity. In organic as well as conscious intentionality a simultaneity embracing a past and a future acts as *a directing presence in the succession of motional situations* or psychic complications. In the one case the higher dimension is, as it were, turned outwards in space, in the other case it is turned inwards to the subject.

Two Principles of Relativity

" Absolute space " realised as a simultaneous presence of the perceptive power in the visual (or perceptual) field of the moment is something different from the absolute space of intellectual intuition, realised as a formal, a-dynamic simultaneous presence of infinite or indefinite extension, and we use the latter as far as possible to correct the perspective illusions of the former and to realise the unity of the world as a totality. But it is of course possible to make the visual field *represent* ideal or formal space, and in this case the question about real simultaneity is very easy to decide, because the latter is then identified with the simultaneity of visual perception. Simultaneous, is that which is *seen* simultaneously. But as that which is seen simultaneously

by one may be seen at different moments by another, simultaneity is in this way made relative to every subject and even to every succeeding "now" in subjective experience. While the "absolute space" by which simultaneity is realised is limited to the visual field of the moment, "absolute time" is here identified with the rhythmic succession of nows in subjective experience. As the objectivation of simultaneity and motional times is obviously dependent upon the objectivation and universalisation of "absolute space," it is evident that the objectivation is minimal, when "absolute space" is limited to the visual field. It is as yet subjective and phenomenal.

In the theory of relativity we have not got to do with an extreme subjective relativism, though the subjective and positivistic tendency trying to identify reality with that which is sensually "given" plays a prominent part in it, as is evident from the frequent references to the "observer." But the theory is in the first instance physical and cannot disavow the degree of objectivity implied in physical thought. The reality of motion as something different from the sensually given is involved in it, though there is a tendency to limit the objectivation of it to the domain of formal and purely mathematical formulation and to evade a really dynamic objectivation. It must be remembered that the theory had its origin in the negative result of the attempt of Michelson-Morley to determine the absolute motion of the earth by its relation to the velocity of light.

Absolute space and simultaneity is in the theory of relativity not identified with the visual field, but with the physical motion, by means of which it is realised physically, viz.: the velocity of light. As sight is the most dominant and perfect sense considered as a means of psychic communication with physical reality, so the

velocity of light comes nearest to the realisation of spatial simultaneity *within* the sphere of motion, because it represents the highest velocity known to physical science. The most rapid signals needed to define the physical simultaneity of distant events are exchanged by light, though it does not answer to the ideal signals, which would demand an infinitely rapid or rather timeless propagation, that is to say, a really *simultaneous presence* in *real* space, making any motion superfluous.

Thus in the theory of relativity real simultaneity is not defined by the simultaneity of subjective perception alone, but by subjective perception taken in connection with the propagation of light: two events in different places " A " and " B " *are* simultaneous, if they are seen simultaneously by an observer stationed at an equal distance from the two places. The intellectual realisation of space does not imply an omnipresence in *real* space, but only an ideal omnipresence in a formal constructed space. Therefore it cannot be used for physical definitions of simultaneity. The nearest approach to omnipresence in physical or real space is light, which therefore can be used for physical definitions and determinations. But on the other hand light is itself physically defined as a velocity of 298,000–300,000 km. per second, and thus falls short of the timeless velocity necessary to realise a simultaneous omnipresence in space. If, then, it is made to replace an absolute or universal space as a basis of physical definitions, this can only be done by a system of relativation accounting for the deviations from the real simultaneity of such a space by the perspectivity involved, if not in the singular subjectivity of the observer, at least in the special cosmic state of motion in which he *sensually* is immersed.

That the velocity of light in the theory of relativity is made to replace absolute space in the sense of a simul-

taneous presence in the universe as a totality is shown by the formula about its constancy, according to which the measuring of the velocity of light in every uniformly moving system in the world must give the same result, whether the system is moving to or from the source of light. That is to say: the velocity of light is a fundamental invariable quantity in relation to the motions in the universe, in the same sense as absolute space has been till now. As the latter is indifferent to the systems moving in it, so is the velocity of light to the system of relation.

The perspectivation of space and time in the theory of relativity is therefore analogous to the results which appear, if—*without taking our stand upon the principle of relativity*—we adjust our watches and metres upon the presupposition that the velocity of light means real simultaneity in absolute space: the slowing of the watches and the shortening of the metre in the direction of the motion. We may suppose that two observers "A" and "B" compare their watches and adjust them perfectly to each other. While A with his watch remains at the starting-point, B removes himself from it with an increasing velocity, but adjusts his watch to the watch of A by means of light-signals received from A every second. The result of the increasing velocity and distance of B from A will then be an increasing delay in the arrival of the signals, and the motion of the hands of the watch will therefore be slowed accordingly. If the motion of B reaches the velocity of light, his watch will stop, because the reception of signals is only possible when the motion of B is slower than that of light. And further: if the length of a metre removing itself with increasing velocity from A in the direction of its axis and along the line of vision is to be judged by the simultaneous perception of two light-signals flashing up

every second from the two ends of the metre, the result will be a gradual shortening of the length of the metre. The flashlight from the farther end of the metre has a longer distance to pass to the eye than the light from the nearer end. This difference of distances will be longest when the metre rests in relation to A. But it will decrease with the increasing velocity of its motion, and it will be 0 when the metre removes itself as rapidly *from* A as the light-signals move *towards* him, i.e. when the motion of the metre reaches the velocity of light. Thus the time-measuring units of the watch and the length of the metre may be perspectivised according to their velocities of motion in relation to that of light, and the latter is not here used to correct the deviations from real simultaneity in absolute space produced by distance and motion, but treated as if it were absolute space and simultaneity itself.

Now the perfect correction of deviations from real simultaneity in absolute space, caused by motion and distance, is dependent upon certain conditions of knowledge. Resting observers exchanging light-signals will be able to correct their watches, if they know the distance between them and the velocity of light as the same in both directions. If both of them are in motion, they must know their true state of motion in absolute space and the velocity of light in it. If their absolute motion is unknown and only their relative motion known, the correction is impossible, even if the velocity of light is known. But the errors may be reduced to a minimum. If the relative motion and even the distance are unknown, every correction becomes impossible.

The great difficulty is the determination of absolute motion, and the perspectivation of space and time in the theory of relativity according to the state of motion is based upon the negative results of the attempts to

determine the absolute motion of the earth by means of the velocity of light, and upon an interpretation of the experiments of Michelson-Morley, by which the velocity of light is considered independent of the state of motion in which the observer is partaking, so that a light-signal will reach the observer in the same time, whether he approaches the starting-point of the signal or removes himself from it. And here the principle of relativity comes in. This principle excludes absolute motion and involves the consequence that every motion is determined by its relation to another motion, which for the time being is regarded as rest, while the latter motion must be determined in relation to the first motion, which then in its turn must be considered as rest.

In reality this implies the liberty to make any state of motion represent " absolute space " for the time being, as it is represented by any momentary field of vision shifting from " now " to " now " in the subjective experience of the observer. In the theory of relativity the shifting is not from one subjective field of vision to another, but from an objective field of motion to another, which then for the time being is identified with rest, i.e. with absolute space. This shifting of resting point is in the theory of relativity called " Wahl des Bezug-systems " or choice of the system of relation. Of course this choice is intellectual or mathematical, not sensual. It is a means to effect the practical unification of a small or large area of the universe, but cannot, like the absolute space of previous physical thinking, serve to unify the whole universe, which in the theory of relativity is done by the formulas of transformation, by which the point of view is shifted from one system of perspectivation to another. It will be understood that the mathematical determination of the motions will vary according to the choice of the system of relation.

But from this rule the motion of light is excepted. For the determination of this motion the choice of the system of relation is indifferent, as a correct determination of distances in absolute space would be the same regardless of the motion of the body from which it is undertaken.

Now this principle of relativity, by which the relativist deems himself at liberty to regard a state of motion alternately as motion and rest, has a double root, which must be clearly distinguished, if confusion and contradictions are to be avoided. One root is the phoronomic point of view limiting itself to a consideration of different motions from a phenomenal, a-dynamic standpoint, sufficient to permit a mathematical description of them. The a-dynamic indifference characteristic of this mathematical view is then transferred to or identified with the other root: the *mechanical* indifference by which single mechanical systems are apparently made perfectly independent of each other dynamically, when their motion in relation to each other is uniform and rectilinear (or practically so).

It is well known that, if we look out of the window of a moving train, we may shift the point of view realised in the field of vision in such a way that the train seems to be at rest while the surroundings are constantly passing in motion. Now this is known to be a sensual or phenomenal *appearance*, which may be realised from a subjective, but not from an objective or dynamic point of view. But for the mathematical description of the relative motions this phenomenal appearance is quite sufficient, and to the mathematical point of view it is indifferent whether the train or the surroundings are considered as moving, because the aim of the mathematical operations is only to determine a motion in relation to an ideal point of rest, apart from the question whether this rest is dynamically real or not.

Sensually or phenomenally motion may be described as a change of distance between two points or a number of points in space. But such a change of distance is not sufficient to decide which of the points really is in motion and how rapid the motion really is. Owing to the a-dynamic character of the mathematical point of view no point in this space has any preference over another. The mathematician may therefore at pleasure choose the point of rest necessary to his determinations, in consequence of the fact that this point is no real thing in real space, but only a constructed system of co-ordinates. Real or absolute motion is no necessary presupposition of mathematical determinations, because mathematics has nothing to do directly with reality. But the system of co-ordinates may be moved outwards, as it were, from phenomenal into real space, and then it must be identified with a real thing, which for the time being must be considered at rest, as the fixed point of mathematical determinations. This identification of the system of co-ordinates with a thing in motion implies that the motion of this body for the determinations in question is not taken into consideration. The motion of a body can only be an object of thought and determination, when it is not used as a system of relation, but is considered from another system of relation determined by another moving body. Two or more moving bodies cannot simultaneously, but only alternately serve as systems of relation. The system of co-ordinates is identified with the earth in all cases when it is possible to abstract from its motion. In other cases the sun or the fixed stars are chosen as systems of relation.

But it is evident that in the case of such a transition from the phenomenal or mathematical to the real space, the mathematical indifference as to the choice of resting-point must be given up. In real space it is no longer

indifferent whether we consider a body as moving or resting, or which of the various moving bodies is used as a system of relation. The choice of the system of relation must be justified in some way. The reason for this is to be found in the dynamical or causal relations presupposed to exist between things or elements in real space and serving as an explanation of sensual phenomena. It is sometimes said that the principle by which the choice of a system of relation is to be justified must be a purely pragmatic one. The choice which permits the simplest and most practical interpretation must be preferred. It is true that this principle as a heuristic one may serve as a basis for a preliminary reconnaissance, as it were, into the world of reality. But when, for instance, we prefer the supposition that the fixed stars may be regarded as resting, while the earth is revolving round its axis, and reject the opposite supposition, that the earth is resting, while the fixed stars in 24 hours move round the earth traversing a distance which would have to be reckoned in myriads of light-years, the reason is not only practical, but dynamical and causal, because the latter supposition would make impossible a reasonable causal explanation of the motions and their interrelation. We are by this causal rationalisation of the dynamic relations in the world of reality led to identify the system of co-ordinates with material spheres, the one wider and embracing more than the other (earth—sun —fixed stars), and in this way we must come to an ultimate dynamic sphere, *representing* formal space, or rather a simultaneous presence within the *whole* sphere of motion, and therefore serving as the last system of relation to which a dynamical rationalisation of the world can lead us. To determine the motions in the universe by and from this last system of relation would of course be the most perfect empiric apprehension of

them. But so long as the relation of the various motions in the universe to this ultimate dynamic presence cannot wholly be determined, we have to content ourselves with approximations and mathematical constructions or fictions based upon formal space (as an abstract sphere of infinite possibilities) and practically adapted to the special task in view.

This inability to define the relation of the various motions in the universe to the last dynamic continuity does not imply the invalidity of the dynamic interpretation of them, as far as it goes. It must be remembered that from the dynamic point of view every relative motion *involves* an absolute motion, i.e. the relation of the motion in question to the last dynamic sphere. Even from the phoronomic point of view absolute motion must be attributed to n out of $n + 1$ apparently moving bodies, the last (or $n + 1$th) in this case representing absolute space or the point of rest. The determination of motions in relation to moving material systems, which from a dynamic point of view are preferable as systems of relation, must therefore be considered as provisionally and approximately correct. The deviations from absolute motion must lie within certain limits.

But the theory of relativity has, as we have seen, another perhaps more conspicuous root in the *mechanical* indifference, by which material systems are isolated from each other in the case of uniform rectilinear motion. Owing to this indifference it is impossible, by means of material processes within the mechanical system as such, to decide whether it is in motion or not, or how rapid this motion is. The consequence of this is, that the system with respect to its own processes may be considered as resting.

Now it must be evident that if this indifference were absolute it would amount to a perfect dynamical isola-

tion, which would make it impossible to the observers within one mechanical system to have any sensual perceptions of another system. Within the sphere of motion the mechanical isolation of moving systems can only be approximate, and it must be remembered that the mechanical relations between different bodies within a material sphere, where the differentiation of matter has reached the *solid* stage, are only made possible by a long process of cosmic material differentiation and solidification.

It is therefore generally conceded that perfect dynamic isolation is impossible in the real world. The law of inertia is based upon such a perfect dynamic isolation —the supposition that a body remains in a state of rest or motion without being exposed to any influence from the outside. But this supposition is only a construction of thought affording a good basis for the dynamic interpretation of motions. It is not an observed fact or necessary material reality.

While the phoronomic or kinematic principle of relativity is an expression of the fact that the mathematical description of motion must be made relative to a fixed point or system of co-ordinates, whether the rest of this point is only apparent or not, the mechanical principle of relativity is based upon the supposition of a mechanical (and therefore dynamical) reality, which under certain conditions permits a relation of approximate indifferent isolation to exist between differentiated material systems. The question in the latter case thus is, to decide when and where such a relation is realised in physical reality. It may be supposed to exist *approximately* between different cosmic bodies or world-systems. If it is applied to light, it is possible to consider the source of light as a comparatively isolated mechanical system and the motion of light as a mechanical process belonging to

this system. This is the hypothesis of *Ritz*, which would explain the results of the experiments of Michelson-Morley, but is rejected by Einstein, perhaps prematurely, as the astronomical investigations of the dependence of the velocity of light on its source seem to be difficult and uncertain. But if the motion of light according to the wave-theory is considered a material process belonging to the mechanical system "ether," representing absolute space (or rest), the difficulties connected with the experiments of Michelson-Morley appear, which Einstein tries to overcome by his theory of the constancy of the velocity of light, involving the consequence that the velocity of light is the same relative to every mechanical system, independently of its state of motion, in which of course all observers belonging to it are involved.

It will thus be understood that the foundation of the kinematic principle of relativity is *psychic*, i.e. it is only dependent upon psychic conditions for the *apprehension* of motion, especially the condition that motion can only be apprehended and determined in relation to an immovable background identified with absolute formal space (the system of co-ordinates). On the other hand, the foundation of the mechanical principle of relativity is *physical*, and consists in the peculiar relation of indifferent isolation realised within dynamic reality between mechanical systems as separate dynamical unities or approximately so.

If we now ask for the true relation between these two principles of relativity, it must be remembered that when we transfer the system of co-ordinates from the immovable formal space of mathematics to physical space and identify it with a real mechanical system moving in relation to another, we abstract from the fact that it *really* is moving. As the system of co-ordinates repre-

sents the rest of formal space, its application to a real moving body presupposes the possibility of this abstraction. But this *kinematic* rest by means of which a mechanical system can be made a system of relation for the mathematical determination of relative motions, is of course a *fictitious* one, serving mathematical purposes and our orientation in the world of dynamic reality. We must beware of treating this kinematic rest as if it were a real one or could produce real dynamic effects in the physical world.

But on the other hand we must remember the fact that in the case of approximately perfect dynamic isolation between different mechanical systems moving in relation to each other, it is possible to abstract from the motion of the single mechanical system and deal with the motions or dynamic processes going on *within* this system, *as if* it were at rest as a totality. Now it is not difficult to understand that the foundation of this possibility is not kinematic but dynamic, consisting in the fact that the single mechanical system is a *dynamic continuity* involving all its parts and particles in a motion common to the system as a whole.

Thus we are in the case of mechanical systems dynamically only entitled to apply the idea of rest to the whole *in relation to its parts*, not to the whole in its relation to other wholes or mechanical systems. In the latter case I can only from a formal kinematic point of view regard the one mechanical system as resting in relation to another.

What makes a physical complex a mechanical system is an inner dynamic coherence which is broken in the relation between the system and other systems. Here, then, we have to do with a dynamic, not a kinematic *rest in motion*, a dynamic principle oppositely related to the motion as such and furnishing a certain *foothold* for

the application of formal space and the kinematic principle of relativity to the real world of motion.

Only in so far as this principle of continuity and rest is dynamically realised in the sphere of motion is it possible to rationalise it. This will easily be understood if we consider the separate mechanical systems in relation to the formal means of unification and rationalisation. Foremost among these means we find the idea of simultaneity, because the comparison or measurements of different motions in relation to each other is conditioned by this idea. But here it must be remembered that this idea is inextricably connected with formal space and therefore with absolute rest. It is impossible to apply the idea of simultaneity to moving bodies without indicating the points in formal space (as a substitute for the real) which they are supposed to occupy in the same moment of time. In fact, *formal space is nothing but an intuitive psychic realisation of simultaneity.* It is the simultaneity of objectivation (or the outer sense), as the subject may be called the simultaneity of subjectivation (or the inner sense). And the reason why formal space cannot be considered as moving is the ideal perfectness of its simultaneity. Formal space must be considered as present beforehand in all points within it. Consequently it *cannot move.*

But—the mechanical systems do not rest, they are moving. Consequently they do not fulfil the condition for a *perfect* unification and rationalisation by means of the idea of simultaneity. The idea of simultaneity cannot be applied to moving bodies without translating their motion into rest. When I indicate the points in space simultaneously occupied by different moving bodies I take a mental picture of them in which the bodies in question do not move, but rest in relation to each other as in a snapshot. Thus the mental picture is *not wholly*

true. It is produced by a fixation of that which in the motional reality cannot be considered as fixed.

We are here confronted with a deep-seated antagonism between the a-dynamic principle of formality and the dynamic principle of reality. The exact perfectness of formal geometry and mathematics is conditioned by a perfectly a-dynamic immobility, in which motion owing to its dynamic nature introduces an element of irrationality. Therefore dynamic reality is as a sphere of motion insusceptible of a *perfect* rationalisation. The rationalisation of it can only be approximate, and it will be dependent upon the degree in which the necessary rest is realised as a *dynamic continuity in motion*.

As the exact perfectness of the simultaneous continuity in geometric space is due to its a-dynamic and abstract formality, we cannot expect to find it so perfectly realised within the motional sphere. In the domain of reality it will have to struggle with the irrational dynamic element connected with motion. Thus the most perfect realisation of a simultaneous continuity in the sphere of motion would consist in a *universal motional unity, within which no mechanical system could be discriminated or isolated from other mechanical systems*. Such a motional unity may be four-dimensionally realised in the universal real space as the dynamic continuity within which the various cosmic bodies are moving. But the latter are in greater or less degree related to each other as separate mechanical systems, and in so far the four-dimensional continuity is broken. It is as though a precious vase were broken into fragments which cannot be joined together with the perfection of its old continuity. Thus, the motional isolation of mechanical systems represents an irrational principle of discontinuity in opposition to the rational principle of continuity. The continuous space and time are, as it were, broken up by them into

separate spaces and times, as every such mechanical system may be taken to represent a separate dynamical space-and-time definition.

But within the single mechanical system the dynamic continuity may be considered as realised in some way or other, and this circumstance in connection with the fact that the mechanical isolation itself can only be approximate leaves a very wide field for the rational unification of the sphere of motion. But if every atom or electron were a perfectly isolated mechanical system the world would be a chaos, not a kosmos, and the rationalising activity of science would have no foothold in reality.

Velocity, Simultaneity and Space

It would lead us too far if we tried to elucidate in detail the part played by the two principles of relativity in Einstein's theory and the confusion resulting from a too vague application of them. Suffice it to say, that the constancy of the velocity of light is a weak point in Einstein's theory. It seems reasonable to say that, if it is indifferent to the observable velocity of light, whether the observer approaches the source of light or removes himself from it, light must have the peculiarity of traversing a shorter distance in the same time as a longer without changing its velocity, which would involve an infinite velocity or the velocity of simultaneity. There are two ideas which clash at this point in Einstein's theory. The one is the idea of a certain definable velocity as the highest in space, the other the idea of simultaneous presence or rest in space, in relation to which velocities of motion are indifferent.

Now it would be easy to speak of contradictions. But if we take our stand upon the difference between the

formal and dynamic point of view—or between formal and dynamic space cleared up in a foregoing chapter—we shall find this contradiction symptomatically connected with a very important question in our conception of the universe. What is contradictory from a formal point of view need not be so from a dynamic standpoint. At least it must be evident that the question of a highest velocity which cannot be transcended is different according as it is considered in relation to real or formal space. In formal space no velocity can be the highest, because formal space is only a possibility, which can be expanded at liberty or infinitely, so that a certain velocity, which within a limited space would practically mean simultaneous presence, in a vastly more expanded space would be very slow. Formal space involves infinite *possibilities* of velocity as well as slowness. But real space in relation to formal space must, as we have seen, be *dynamically defined*, which means the exclusion of the infinity of possibilities and a definite limit to motional velocity. In a limited universe the scale of velocities must also be limited.

The highest velocity in real space, then, must be a velocity by which this space is dynamically defined and realised as a simultaneous presence or rest in relation to all slower motions in the world. And here we are confronted with the conception of a fourth dimension in the sense which I have tried to elucidate in the foregoing pages, i.e. the conception of a time-power defining itself in the highest velocity of the universe and using it to unify the whole sphere of motion as an *organic life-sphere*. As life practically means an enduring simultaneous presence within the organism, as conscious perception means a simultaneous presence of the perceptive power within the field of perception, so there must be a four-dimensional simultaneous presence within the

whole universe limiting and defining itself in the highest velocity possible within it.

Thus the dynamic continuity of the universe may be considered in the light of rest as well as of motion, the rest appearing in the organising force, by which the highest velocity in the universe is *curved* in such a manner that it is made the medium of simultaneous presence or unsuccessive duration. This curving will then appear as a dynamical background of periodicity and rhythm, real space having the character of a dynamic sphere revolving into itself, a character which very aptly may be expressed in the old symbol of eternity: the snake biting itself in the tail.

Thus a transcendence beyond this highest velocity does not lead to a yet higher velocity. It can only lead out of the sphere of motion altogether and into a sphere of dynamic simultaneous continuity, which may be considered as *negatively* related to real space, if motion is considered as *positively* related to it. That is to say: so long as we have to do with motion, we look upon space from the outside, as it were, and from a point of view, by which the discontinuity of its different places, bodies, elements, etc., is emphasised. But when we are considering the highest velocity of motion and try to surpass it we come to the conception of a simultaneous presence, by which every motion is made superfluous, and by which space is looked upon from the inside or from the standpoint of continuity as antagonistic to discontinuity.

If the question of the highest velocity in the universe is considered from this point of view, the apparently impossible consequences, to which a velocity higher than that of light would lead according to the theory of relativity, become intelligible. These consequences only confront us with the fact that in real space the highest

velocity must be a turning-point, in which an inversion takes place from discontinuity to continuity, from the outside to the inside, from extension to intension of spatial existence, from a positive to a negative dynamics of space, both of which may be regarded as necessary—as the two scales of a weight—to the constitution of reality. We might also call this inversion a transition from an affirmation to a negation of mass or matter, from the material to the immaterial side of spatial existence, because the highest velocity implies the reduction of mass or matter to zero.

But if the conception here expounded is correct, the velocity of light should not be the highest in the universe, though it may be the next highest, because light presupposes a real space in which to appear. If the highest velocity is that by which real space is dynamically defined as a practically simultaneous presence, this velocity, and with it real space, must already be a fact, before light can appear. It seems most natural to connect light and gravitation with each other as two opposite but correlated forces, appearing together because necessarily involved in material *differentiations* and condensations *within* real space or a pre-existing cosmic life-sphere. The probability of this is strengthened by the fact that the propagation of gravitation seems to have the same velocity as that of light (a result to which Gerber had come previously to Einstein). It must be remembered that the propagation of light, as well as gravitation, is connected with a material *centralisation* within space—light radiating outwards into space from a centre, which in the case of gravitation may be considered as a centre of an attractive radiation inwards, as it were. Such centralisations within real space cannot be identified with the process by which real space as a totality is originally constituted. The motion by which this pro-

cess is realised must be supposed to have the highest velocity, and to be representative of dynamic simultaneity and absolute space, as well as absolute time, considered not from a formal standpoint but as expressive of the dynamic unification of the world as a totality. As motion it would, because mass-less and continuous, have a unique position.

In the middle of the nineteenth century the theory of the well-known German philosopher, *Trendelenburg*, that space is a product of motion, caused much attention and discussion. His theory was based upon premises very different from our investigations, as he looked upon motion in the Aristotelian sense as common to thinking and being. Against his view of space it was of course objected, that as space is a condition of motion it cannot be a product of it. If this objection is applied to real space in our sense of the word, we must distinguish between separate or differentiated motions, and the original motion by which real space is defined. In the latter case space cannot precede motion, because the spatial extensification itself and motion here must coincide.

Separate motions are only intelligible within a spatial field already existing, but in the case of the primary spatial extension no such spatial field exists beforehand. It must be created dynamically, i.e. by motion. The chief obstacle against this view is the illegitimate confounding of formal with real space, which leads to conceiving the latter as a dead emptiness, by which motion is destroyed or suffocated, not as a living unity of simultaneous presence, by which motion is transcended and organised. Universal space is not rigid and dead rest, but rather a perfection of motion, which here in every place and every moment may be considered as finished, because it has no special aim outside itself and therefore

needs no differentiations or materialisations to realise such aims. Real original space must be considered not as the rest of death, from which no motion could arise, but as the rest of life, within which special motions are produced by a *slowing down*, not by a further intensification or activation.

If this is realised, it will be understood that space in the usual sense of the word is a very poor designation for this original (or as we have previously called it: last) unity of the world. The word time-space is better, because it implies some consciousness of the fact that when space is defined dynamically time is also involved in it. But it must be remembered that the simultaneity of presence attributed to this original unity cannot be conceived as time in the usual sense, because the succession, which to us is the characteristic feature of time, can only arise by a slowing down of that maximum of velocity by which simultaneity is realised. Every *special* time must be realised as a succession *within the abiding simultaneity* of the primary time-space, and it will easily be understood that such specialisations of time are involved in every centralisation and differentiation of a material world-system within the universe. The original time-space of the universe must therefore in relation to the separate world-systems rather be called *abiding uniform duration*. In place of its original simultaneous presence we are confronted in the world-systems with a succession.

This will be better understood if the relation of time to velocity is kept in mind. The different degrees of velocity are measured by time and thus related to it. But on the other hand there is also a certain antagonism between time and velocity. The increase of velocity reduces the time needed to the traversing of a certain distance, while the decrease of velocity implies an

increase of time (or succession). Thus velocity and time are inversely related to each other when applied to the same extension of space, while space and velocity, applied to the same time, increase and decrease together. If a motion is considered as a maximum of velocity it must at the same time imply a maximum of spatial extension, while the time needed for the realisation of it will be a minimum. Thus a maximum of velocity means the nearest approach to a simultaneous spatial presence, though the extension in this case must be a limited one and stand in a definite relation to the velocity.

Thus it may be said, that the more velocity can do, the less is left to be done by time, which in the case of maximum velocity will be reduced to zero. The motion is in this case equal by itself to space without needing multiplication by time. It is simultaneous extension, in which time as successive extension is swallowed up by or rather raised to simultaneity. Thus this maximum of velocity means that the spatial or extensive differentiation is absorbed into a timeless but enduring unity.

We may look upon every motion as an attempt to overcome the contradiction or antagonism between extension and simultaneity. In the case of the separate motions in the universe this can only be done by means of succession or time. That is to say, the antagonism is only imperfectly overcome. Only in the case of the original space-creating motion is the antagonism perfectly overcome and made a unity. Thus the velocity of the separate motions in the universe can no longer be the original one unimpeded by any resistance, but only a fraction of it, needing multiplication by time or succession to outweigh the preponderance of extension over simultaneity.

Thus space and time are realised in the universe to-

gether, and undifferentiated space means unsuccessive time, changeless duration. The most prominent feature of this original space-creating motion should be, that it has no pre-existing extension or resistance to overcome. Distance and mass have no significance to it. It has the character of a constructive activity opening a vast field of freedom to all specialising activities, which limit themselves to special areas and differentiate themselves by different rates of succession resulting from a slowing down of the original velocity and a suspension of the coincidence between extension and simultaneity. In this way the original velocity is " tempered " into a " tempus " (or tempo) in the first instance into cosmic rhythmic motions.

While formal space with its constructive possibilities is a means in the hands of the intellect to work out an *analytical* rationalisation of the sphere of motion, real space is a dynamic continuity or totality, which can only be understood if intellectual analysis is supplemented by an intuitional *synthesis*. The weakness of a one-sided analytical treatment of scientific problems is, that rational forms—such as space—in their purely a-dynamic and abstract character are used as a substitute for the real synthetic dynamics in existence. The result is, that only the analytical and not the synthetical side of reality is perceived and understood. The synthetical activity in the world-space, in the organisms and inorganic substances, is considered as a matter of course, needing no explanation, or as a purely formal, a-dynamic epiphenomenon to the analytic activity of the discontinuous atoms. This one-sidedness can only be overcome by an understanding of the pure negativity and unreality of rational forms, a view which is perfectly consistent with their absoluteness in normative respect. The difference of the norm from the cause is just that the

norm is a-dynamic and indifferent to real dynamic existence, while the cause is dynamic.

If this is kept in mind it will be understood that a *perfect* rationalisation of dynamic existence by means of rational forms such as space is not to be expected. Dynamism involves, as we have seen, an element of irrationality, which cannot wholly be exhausted in rational formulas. Formal space is the very antithesis of motion, in so far as it is perfectly stationary. In formal space no motion is possible, and the rationalisation of motions by means of space therefore involves the presupposition that motions can ideally be brought to a standstill. And when motions are measured, we are in reality commanding them to stand still for the purpose of measurement by means of formal space and time. In this command the antagonism between formal rationality and dynamism comes to light, because dynamism or motion as such is the very inability to stand still at any point of space or any moment of time.

It will be remembered that the conscious realisation of formal space as well as formal time is effected by a process of abstraction, in which the one is reduced to a mere psychic vehicle of the other. In motion both are only vehicles of force or dynamic intensity, which in itself is something more than the space and time by which it is measured. And it must be kept in mind that in the differentiated universe we have to do with a vast variety of velocities, which relatively and mutually cannot wholly be reduced one to the other.

We have seen in another connection that the very perception of motion is conditioned by a discrepancy in the velocity of succession between the subjective acts of perception and the spatial changes of the moving object. The " now " of conscious perception is different from and has a wider extension than the " now " in which the

moving sense-object occupies a certain point in space. And the same discrepancy may be said in greater or less degree to isolate the different velocities of motion from each other. The spatial " now "—if such an expression may be allowed—is wider in the case of a slower than in the case of a quicker motion, because the slower object may be said to remain in the same point of space longer than the quicker object. And as the " nows " or simultaneous moments are the means by which different motions are compared and measured in relation to each other, the necessary consequence of this discrepancy is a certain limitation to the exactness of this comparison and measurement. The world of motion cannot be brought to a perfect standstill or rest, which is the basis and condition of *formal* exactness. It has a certain fluidity, which evades perfect rationalisation.

By motion spatial existence is not only made dynamical, but also as a consequence of this to some degree irrational. And if the simultaneous uniformity of original motion is differentiated too much—i.e. dissolved into mutually clashing and disharmonious motions—a perfect chaos is the result, insusceptible of any rationalisation.

In motion we are confronted with the dynamic element of existence from the outside. In feeling and will it is experienced from the inside. In both cases there is something in it which resists a perfect rational objectivation and dissolves the rigidity of rational continuities formulated by the intellect alone.

CHAPTER VI

FORCE, ENERGY AND COSMIC PERIODICITY

FORCE AND ENERGY

It is an important fact that the range of motions, which in the first instance are directly perceived by the senses, is widened enormously by intellectual investigations, which detect hidden motions where all seems to be rest and changelessness to the senses : vibrations of light and sound on the one hand and motions of the earth and celestial bodies on the other. The platform of rest, which the " psyche " in the first instance has in the sensual or phenomenal world, is constantly removed from under its feet, until the whole outer world stands revealed as an enormous coherence of interrelated motions, furnishing no foundation for the conception of an absolute rest.

To bring motions to a standstill is a condition of consciousness. Thus the vibrations of light and sound are transformed at the threshold of consciousness into the rest of colour and sound. On the other hand this rest is, as we have seen, a condition of the perception of motion. So we find the transition from the motional to the psychical sphere marked by this transformation into the simultaneity of rest, which in the case of sensual perception is shifting and relative, but by abstraction is widened into the absoluteness of a stationary and changeless space. And it must be remembered that this rest of sensation and space-intuition does not separate the " psyche " from the sphere of motion, but gives it the power in a greater or less degree to interfere in it as well as perceive it. Sensual perception and spontaneous

motion are correlative. And both are conditioned by the same resting space, which may be considered as the Archimedean δός μοι πού στῶ of psychic activity in relation to the motional sphere.

But though consciousness must bring motion to a standstill as a basis for its cognitive functions, it cannot be said that this standstill has no foundation within the world of motion. The cognitive abstraction from motions, not directly or in the first line involved in the nature of the object of cognition, does not make this cognition invalid. It will be correct enough, so far as it goes, if only the necessary reservations are kept in mind, and it must be remembered that the standstill demanded by consciousness has an objective foothold in the *forms* realised by the motions in the outer world.

Forms can be realised not only imaginatively as psychic qualities, but also as moving physical unities. If soldiers are moving in a haphazard fashion, the repose demanded by consciousness as a basis of perception is wanting, and we complain of chaos, confusion, etc. But if they march in orderly columns, they give us the impression of forms agreeable to the eye. Thus we get the necessary basis for cognition in the presence of forms within the sphere of motion, realised in motional regularity and rhythm, though these forms do not rest in the absolute sense of the word, and though they cannot be realised as moving unities with the degree of exactness and purity possible to the constructive mathematical imagination. The absence of an absolute rest in the sphere of motion is inconsistent with the formal purity of the psychic sphere, and there can be no doubt that by sensual perception we clothe the bodies of the outer world with a completeness and smoothness of repose which can only have an approximate physical reality.

The presence of forms in the sphere of motion cannot in the last resort be explained by the same dynamic principle as motion considered apart from form. Now the dynamic principle used by science to compare motions is energy, which when applied to concrete spatial events or motions appears as kinetic work, best understood as the result of pushes mediating the transference of work from one body to another. There is in science a pronounced tendency, also appearing in the theory of relativity, to explain all events in the sphere of motion by quantities of energy only. But this must lead to fundamental difficulties connected with the problem of mass and form or with ordered movement. There is nothing in the conception of energy which can explain the realisation of form and order. On the contrary, the reign of energy means tendency to chaos and formlessness. And it is significant that while we speak of the conservation and equivalence of energy, it is impossible to speak of the conservation and equivalence of forms as a natural law of a corresponding fixed character. Forms and masses are subject to disintegration, and though the energy remains we can find no equivalent for the disappearing form and individual separateness. Heat loses its differences of temperature, light its differences of colour, organic forms become extinct, and globes are dissolved. This means no difference to the quantities of energy. But the loss of form means the loss of the most essential factor.

If energy were the only dynamic principle in the sphere of motion, consciousness could have no foothold of repose in it. That the sphere of motion is a kosmos and not a chaos is due to the fact that energy is linked together with a dynamic principle of opposite character, which we may call *force* in order to accentuate that it has a field of application as wide as that of energy.

The tendency to identify energy with force and to extend this identification to life and consciousness is a result of a deficient discrimination between fundamental differences in existence. Energy does not lead to a full understanding of potentiality of motion, which is intimately connected with force. Potential energy as a fact in nature must in the last resort be explained by force, because energy is essentially kinetic and cannot explain the primary potentialisation. Gravitation, causing the retardation and acceleration of the stone which I throw into the air, is an illustration of force, while the impetus I give the stone by throwing it is an illustration of energy. The essential difference is, that force does not enter into the motion or process itself, which is only the case with energy as the cause of a spatial change in a resting or moving body.

If energy is understood as the pushing power appearing in mechanical processes, it is evident enough that it presupposes the existence of something to be pushed, and this something—the inert or movable mass—may be considered as a product of force, which has nothing to do with motion as such and can only have a regulating influence upon it.

While force is revealed in attraction and is connected with "action in distance," energy is repulsive and connected with "contact-action." Force may also be considered as a negation of the space which is affirmed by energy. This interesting correlation may also be expressed by connecting energy with quantity and force with quality, energy with extension and force with intension. In the physical world we have a multiform co-operation of these polaric tendencies. But from a physical point of view it would perhaps suffice in the first instance to accentuate the fact, emphasised by the biologist *K. C. Schneider*, that energy is connected with

the pushing-impulse and space, while force is connected with mass and with acceleration or retardation.[1]

[1] The development of physics led in the first instance to a mechanistic interpretation of matter and material processes. But as it was impossible to explain *chemical* phenomena wholly from a mechanical standpoint the mechanistic interpretation was largely replaced by a qualitative energism. Lately the discovery of electrons has resulted in an electric interpretation of matter. Undoubtedly there is a fundamental difference between the mechanical and the chemical stage of matter, and both may be differentiated from the electromagnetic stage. In all these stages the energetic aspect may be distinguished from the force-aspect.

In the mechanical stage energy is represented by mechanical motion and force by gravitation. In this domain motion does not reach the velocity of electrons, and potentialisation has here nothing to do with the formation of "mass." Thus the "constancy of mass" could remain a fundamental principle in physics so long as the mechanistic view had the sole sway. But a mechanical combination or separation of masses is fundamentally different from the chemical union or dissociation of elements.

In the chemical domain polarity begins to play a part absent from the domain of mechanics. Though heat undoubtedly has much to do with chemical affinity the investigation of the electrons has contributed most to the understanding of chemical phenomena. The chemical atom is looked upon as a system of electrons moving within it with a tremendous velocity. Now the electrons are either positive or negative, and the central position in the atomic system is attributed to the positive electron around which the negative ones—more or less numerous—rotate in concentric orbits representing a certain equilibrium. Obviously the *motion* of the electrons must be distinguished from their mutual influence on each other or the electric charge represented by them. And the latter may in accordance with its repulsive character be considered as the energy of the chemical stage of matter. If so, there need be no fundamental difference between the negative and positive electron or a negative and a positive charge as such. A negative electron may by *the influence of force* be transformed into a positive one. Force is attraction in opposition to repulsion, and it may—in analogy with gravitation in the domain of mechanics—transform the repulsive tendency of a charge into an attractive one. So the disintegrative tendency of energy is overcome and paralysed, but in another way than in the mechanical domain, where force or gravitation leads to a retardation or standstill of mechanical motion. In the chemical atom motion does not cease, but it is curbed by the attractive force into the identity of rhythmic repetition. Nothing seems to disprove the view that positive electrons are negative ones with the difference that force operates

In the energetic view of nature mass or matter is conceived as energy. And this view may be correct enough, so far as it goes. But it leaves unexplained how the energy which is to be found in the mass is potentialised in such a way that mass or matter appears. It has been shown by Einstein that, if the energy of a body is increased, the result will be a corresponding increase of its mass. In the theory of relativity mass is therefore identified with energy. On the other hand, it has been shown that it is impossible by means of a *purely* energetic view, as has been represented, e.g. by *Ostwald*, to make the structural and kinetic hypotheses of matter superfluous. The energetic view must therefore be combined with a structural view of matter, and it is a characteristic fact that Ostwald himself has adopted the molecular theory, which in the beginning was rejected by him. The attempt to substantialise energy must be considered a failure. Energy considered as substance turns out to be an unrealisable contradictory conception.

through them and the polarisation of energy. In this way force or attraction may be understood to produce more or less comprehensive complexes of electrons according to the intensity of force. And the difference of chemical substances may be connected with the difference of this intensity. The chemical reactions would be characterised by a different participation in them by force as the cause leading to the neutralisation of the products, though the quantities of charges which are bound in these products may differ enormously.

But the electrons have also the tendency to work independently of the reactions, by which chemical substances are produced, and this gives rise to the electro-magnetic stage of the material world. In this stage magnetism may be regarded as representative of force and electricity of energy. The electric charge which in the chemical domain is the cause of chemical reactions and dissociations may in the electro-magnetic domain be considered as limited to the production of fields, and in this work magnetism may be regarded as its counteracting opposite. It is, for instance, emphasised by Mie (*Handwörterbuch der Naturwissenschaften*, Bd. iii, p. 474) that " forces of cohesion " are needed to keep the charges together, and counteract the repulsive energy of electricity which operates also between the " force-lines " of the field.

Thus there is no reason to *identify* mass and energy, but they may be considered as correlative. Energy and mass must appear together. But the relation between them may vary.

We may adopt the view that the so-called " fields " of electro-magnetic radiations are substantial, without identifying their substance or mass with their radiating energy. As the kinetic energy of a flying ball is different from the ball itself, so the radiative energy of the electro-magnetic fields may be different from the latter considered as substance or mass. That we have to do with substance or mass even in light may be taken as a proof that it is impossible within the sphere of motion wholly to detach energy from material substance as a bearer of it, or material substance from energy as the power by which it is moved. But we must suppose that mass or inertia in light is reduced to a minimum. Otherwise we should be smashed to pieces by the matter of light. On the other hand, it is shown that enormous quantities of energy must be potentialised in matter in its gaseous, fluid and solid state. Radioactivity has especially been a means to draw the attention of science to this fact. The energy liberated by the transformation of one gram of radium and appearing in the radiations and heat produced by it, is supposed to be equal to the energy produced by burning 500 kg. of coal. The atoms of radioactive elements may be those in which most energy is potentialised, because mass or inertia in them is at its highest. But there can be no fundamental difference between radioactive and other elements as to the potentialisation of energy conditioning the appearance of mass or inertia, and if we remember that inactive elements such as helium and lead are produced by the decay of radioactive elements, we have little reason to suppose that the radioactivity—or the material decay in which

it consists—can be wholly absent from the so-called inactive elements.

It is therefore supposed that all matter which we know is decaying, though very slowly, and that by this process the energy potentialised in it—or the single electrons combined or packed into it, as it were, by its formation—is liberated and given back to the world-space, from which it seems to have come. It is a remarkable fact that the energetic processes, as we know them in inorganic nature, show a predominance of destruction—entropy and radioactivity leading in various ways to the dissolution of the world-bodies. Thus, while the decay of matter is now a well-known fact, the formation or creation of matter (or atoms) has never been observed. But it is evident that such formation must take place in the incipient stages of the history of the world-bodies, and that this process must be connected with the potentialisation of enormous amounts of energy.

Thus force must be supposed to be a predominant factor in the formation of worlds, while energy has the upper hand in their dissolution or disintegration. But the very fact that the physical world has the character of a sphere of *motion* shows that energy is the preponderant factor in it. Owing to this fact the products of the concentrative and formative processes of force are in the long run abolished by energy.

Force and Cosmic Life

The necessity of a fixed point to the description or determination of spatial motions might lead us to consider all movements in the universe in relation to a last point, which as such could have no movement of its own. This point would then be the centre of gravity of the whole universe. But if we look upon real space as a

cosmic life-sphere in the sense which we have tried to elucidate, there is no reason to suppose it to be centralised in this way. As already suggested, centralisation or punctualisation seems to be a condition of differentiation or individualisation within the original cosmic life-sphere. But as the latter in itself means the negation of all physical mass, form and specialised motion, it must be raised above the necessity of the centralisation which is a condition of physical developments. In so far as we look upon real space as such, it may be said to have its centre of gravity *everywhere*, because every point in it must be considered as a point of transition from a motional to a psychic sphere, i.e. from a sphere in which spatial differentiations and changes are possible to a sphere in which they cease to have any meaning. The cosmic life-sphere may be considered as the boundary-line between the physical world and a psychic world, which is not based upon or involved in physical differentiations. Of course this boundary-line must be everywhere within the physical world. But as it represents the last sphere of unification to physical reality, no point in it can have any dynamical preference before another. It is an undifferentiated continuity veiling a psychic or spiritual life, which is quite independent of physical reality.

The last unification of the world is commonly connected with ether. And as this word is beginning to lose its old meaning in natural science, it should not be inappropriate to apply it to the cosmic life-sphere. If so, we must expect ether to show only *negative* qualities in relation to matter in motion, observable by the outer sense. In other words, it will not be directly subject to detection by physical means—as matter or transferable energy connected with matter. It cannot be conceived as energy, but only four-dimensionally as force, main-

taining real space as a dynamic unity, or defining itself by means of the last and highest energy of motion.

But force has not only to do with the finest and most universal dynamic definition in relation to which physical reality can be considered. It is of course also involved in the specialisations by which the world-systems or world-bodies within the cosmic sphere are defined. In this connection it may also be called life and even cosmic life, in so far as it prepares the ground for the psychic life which is immersed in and dependent on material forms. We have in the preceding chapters accentuated the intimate connection between consciousness and organic life. Conscious life and organic life may be considered as growing out of the same root: the cosmic force or time-power, by which the world-system is formed and defined.

Of course force and life cannot be identified at the present stage of development of our world, when we find force working in inorganic nature as the synthetic principle of mass and matter, while life seems limited to the organic world and cannot be considered as inherent in matter or a special kind of it in the same sense as force is inherent in inorganic substances. But the function of force in inorganic nature is in many respects analogous to that of life in organic nature, and the gulf now existing between the inorganic and organic world does not exclude a common origin of both in previous stages of development. Both may be considered as differentiations from a primary proto-organic stage, a stage of cosmic, not individual organic life. And in this case we may look upon force in inorganic nature as resulting from the working of a cosmic life-principle, by which nebula are formed and world-systems produced.

We have seen that the origin of material world-systems cannot be fully explained from the energetic

point of view. It involves a cosmic force or life-principle potentialising in mass and matter the energies, which are made kinetic by motion, and the life thus incarnating in the moving world-bodies in the initial stages of their development may be considered as the soil, from which individual life and consciousness draw their nourishment in the later stages. As the human body must be born and unfolded to some extent, before psychic life can draw upon its forces for the development of conscious life, so the world-bodies must also be born and reach a certain age, before individual life and consciousness can be developed. And as we may say about the individual human career, that life and force are predominant in the first half of it, while death and consciousness are predominant in the latter half, so the same may be said about the life of a world-system. In the first half of it force and life are preparing the ground for the unfoldment of consciousness and a spiritual life, the culmination of which must take place in the latter half, because, as we have seen, life and consciousness within the physical world to some extent exclude each other.

Thus the flourishing of consciousness in the latter half of a world-life goes hand in hand with the ebbing out of life-instincts and the death or disintegration of matter. And as force must have the upper hand in the earlier stages of the world-development working in the concentration and differentiation of matter, so energy will be predominant in the later stages, appearing in the dissolution and spreading of matter and heat.

So the periodicity in the life of a world-system may be understood as turning upon an inversion in the relation between force and energy or between life and consciousness, force and life having the upper hand in the youth, energy and consciousness in the old age of a world. But whether force and life or consciousness and

energy have the upper hand, we have to do with an unfoldment in time, a definite succession related to a timeless or enduring world-soul. And if we continue to connect the conception of ether with the idea of a cosmic force or life-principle, we may look upon ether in its "tempered" form as a vehicle of succession or rhythm, inspiring motion in the case of life and perception in the case of consciousness. Succession may be subject to acceleration or retardation according to the exigencies of the world-development, and it is, as we have seen, common to organic and psychic life. We have seen that the psychic or conscious pulse must have a definite relation to the organic, and the organic pulse a definite relation to the cosmic, and the ether may in a wider sense be understood as the medium by which these dynamic time-definitions are originally made.

In this way we are led to connect ether with periodicity, the cosmic as well as the individual. And rhythmic periodicity seems inextricably involved in the production of enduring forms and masses in the sphere of motion. Thus ether is not only connected with the periodicity of rotation, by which the time-rhythm of the various world-bodies is adjusted, but also with the periodicity in the life or existence of the world-systems, determining their formation and dissolution, their exhalation or inhalation—to use a good image from Indian mythology. Though the universe as a totality may be considered as enduring, the various world-systems within it have a limited but a very long life. They seem to appear and disappear periodically, and as a medium of this (and all other) periodicity in the universe the ether must be supposed to function as an organ of adjustment, by which the necessary equilibrium within the universe as a totality is brought about. If so, the ether should be a means of balancing the pairs of opposites, by which the

periodicity in the life of world-systems is realised: the contrast between force and energy, between attraction and repulsion, between gravitation and light, and also between life and consciousness.

The Formation of Worlds

Owing to the one-sided energetic view from which natural phenomena are explained by science, the understanding of the periodicity in the life of the world-systems is very imperfect. From the energetic point of view the processes leading to the disintegration of a world-system are, as we have seen, very clear, but not the processes by which a new world-system is born or developed. The energetic processes must in the long run lead to the depreciation of energy, the disintegration of matter and the cessation of motion. If therefore the energetic processes were the only aspect of activity in nature, no nature could exist at all.

Of course the question how new world-systems are formed has been thoroughly discussed by science, and several attempts have been made to explain the origin of nebula from the usual energetic point of view. But they cannot be called a success. The suppositions of Arrhenius, for instance, that rotating nebulæ are produced by the collision of extinct and dark world-bodies, that motion and density are imparted to nebula by masses entering them from without, and that though energy is depreciated in solid systems it is improved in nebula, are not satisfactory and cannot conceal the impotence of science to master this problem by its usual methods.

The point of view offered by Boltzmann, who considered the problem in the light of probability, attracted much attention. He admitted that the predominant

probability in the universe is in favour of disorder and chaos, and that entropy has the upper hand. But in an infinite universe there is room for the improbable as well as the probable, and the formation of new world-systems realising order and law may thus be considered as improbable and therefore rare cases within predominant entropic tendencies. Notwithstanding their improbability and rareness, ordered world-systems should be necessary, because the improbable in an infinite universe is a necessary factor within the total probability.

Professor Nernst, who has dealt with the problem lately, calls attention to the enormous quantities of energy—the " zero-energy "—which must be accumulated in the atoms. According to his hypothesis there is an equilibrium between the zero-energy in the material elements and the zero-energy in the light-ether. But deviations occur in this equilibrium on the one hand by radioactivity leading to a transformation of the zero-energy of matter into the zero-energy of light, and on the other hand by a sort of accidental condensation within the light-ether leading to the formation of individual chemical atoms consisting of zero-energy.

As the average density of matter in the universe would be satisfied if one atom of uranium were to be found in every 100 litres of space, the mass of the world would remain constant if only one such atom of uranium were formed in the ether in every 1,000 millions of years or even much more rarely.

Professor Nernst thus tries to make the coming and going of matter intelligible. And his hypothesis is undoubtedly the most interesting, because it points directly to a sort of periodicity resting upon the opposition between light and matter (or gravitation) and demanding a shifting equilibrium between the two. But it will easily be understood that the original formation of

world-systems is not satisfactorily explained in this way, and it is a symptom of weakness to make a purely accidental factor—the fortuitous formation of atoms within the ether—responsible for the development and maintenance of world-systems.

The hypothesis of Boltzmann demands a practically infinite universe, a supposition which is not supported by the latest investigations of science. According to the renowned astronomer Seeliger the velocities of the stars, conditioned by gravitation, would be much greater in a quasi-infinite universe than they are in reality. And in continuation of the work of Herschel, Seeliger has been able to show that the number of the stars decreases with the increasing distances. The distribution of stars must therefore be limited, and the number of them is estimated to be 35–40 millions. As half of them are supposed to be in a stage of youthful development, the hypothesis of Boltzmann is not confirmed, because it presupposes very few stars in the stage of youth.

The theory of relativity has opened up new points of view from which this problem can be discussed. According to this theory the world is neither finite nor infinite. In the first case the energy radiating outwards from the world-bodies would be checked and reflected by artificial spatial boundaries—an impossible thought. In the second case all energy would be lost in the infinity of space—a supposition not less impossible than the first and depriving all natural explanations of their basis.

By means of the idea of four-dimensionality it is possible to escape the dilemma of a finite or infinite space. In the first instance, this four-dimensionality has been conceived in conformity with the metageometry of Riemann, according to which space has a positive curvature, involving the consequence that what appears to

us to be a straight line returns in itself as a circle. If this conception is applied to the universe the energy radiating from the world-bodies must in the last resort return to the point of departure and cannot be lost. Now this result is, of course, the same if the four-dimensionality is not conceived mathematically on the basis of the metageometry of Riemann, but dynamically as a definition of real space by means of a cosmic force correlated to the highest velocity and therefore also to the highest kinetic energy in the universe. In this case real space will, like the space of Riemann, return into itself, and the energy cannot be lost in infinity, but must periodically be available for the formation of new nebulæ. The difficulty that such a finite space would have artificial spatial boundaries can in this connection have no significance. It is only an illusion resulting from an illegitimate identification of real with formal space. The boundaries of the spatial world as a totality are to be found in the transition from physical to psychical reality, the real direction of transcendence and infinity.

The cosmic force—or ether—by which real space is defined, must within the latter work in a way similar to that in which organic life is working in the living body, and the expansion of the universe is thus raised from a " mere " or empty space to a " time-space," which must impart a certain periodicity to the formations going on within it. It is owing to this dynamic definition of real space as spheric that straight lines or radiation cannot eternally keep the same direction in it—as in formal space—but must return to the same point. Thus the inherent periodicity of real space is only an expression of its organic four-dimensionality.

In the light of this organic view of spatial reality it will perhaps be understood that the straight lines and angles of inorganic nature around us, in which the

abstract intellect of mathematics has a sort of outer correlate in the sensual world, cannot be universalised cosmically, because cosmos is organic, not mechanical, and has the predilection of organic life for curves, arcs, circles and periodicity. The inorganic world and its masses may then be looked upon as a sort of " slag," thrown off by the processes of life, in which the real development of the world-bodies consists. It is true that vast quantities of energy are deposited in this " slag," that it bears the stamp of its origin and has an essential function to discharge in the life of a world-body as a whole. But it is rather representative of the death- than of the life-processes of the cosmos, and the energetic processes going on in it must in the long run lead to its disintegration.

These energetic processes must in the last resort lead to a maximum of repulsion, by which the finest particles of matter are spread throughout space. That is to say: the energy which by the formation of the world-system was potentialised in matter or form is by these processes once more made kinetic. Some physicists suspect that the world-space is filled with a remarkable sort of radiations, the so-called gamma-radiations, which are not emitted by any element known to us. At any rate the source of these radiations is not to be found in the earth, the sun or the moon, though it is doubtful whether it may not be sought in the outermost strata of the atmosphere. However this may be, we may imagine that the electrons or finest particles liberated by the energetic processes resulting in the dissolution of matter in the last resort are seized by the " time-space " of the universe and involved in a cyclic motion representing the periodicity and velocity of real space as well as the utmost degree of material rarity consistent with motion, i.e. zero. Thus the maximum of disintegration, repul-

sion and kinetic energy in the universe is counterbalanced by the cosmic force or life itself using it for the dynamic definition on curving of the world-space and for the realisation of that simultaneous organic presence, characterised in the previous chapter.

But apart from this there must, of course, exist in the universe special points or centres of *attractive force*, where the liberated energy is seized and transformed into nebulæ by potentialisation. And if we ask for the *inner* reason of this, we must look for it in the psychic sphere of the universe. It is at least reasonable to suppose that the equal uniformity and periodicity, which we must attribute to the world-space as an organic "sphairos," in which the energetic extension and the organic intension (or force) coincide, are the outer expression of a state of harmony on the hidden psychic side of the universe needing no "descent into matter" or motional differentiation for the realisation of its inherent nature, while the psychic state leading to the formation of world-systems may be a state of disharmony, or at least of discrepancy between that which "is" and that which "should be," of such a nature that a special externalisation and motional differentiation is needed to the adjustment of it.

We have seen that succession or rhythm is an essential factor in the development of a world-system. Now it will be evident that a specially defined succession can only arise within real space by a retardation of the highest velocity in the universe, in which spatial extension and organic cosmic simultaneity coincide. But apart from this, all special successions arising in the universe will have the peculiarity that they are susceptible of acceleration as well as retardation. In this respect they will be totally different from the eternal equal uniformity of real space itself.

Thus the formation of a nebula should in the first instance involve a retardation or *relative* standstill within a limited area of real space brought about by attractive force acting by centralisation, and this force of attraction and retardation will in relation to the nebula work in a way analogous to that in which cosmic force or life operates in real space, viz. as a *substantialising* activity. Now it should be evident that a perfect attraction unchecked by any antagonistic activity would result in pure homogeneity of matter in the nebula, and as this must be considered impossible within the sphere of *motion*—or at least only relatively realisable—we may look upon rhythmic successions as the energetic correlate of the attractive force, by which heterogeneity within real space is in the first instance brought about. Force and energy will always and everywhere in the motional sphere be in some sort of co-operation, therefore also in the initial stages of nebular formations. But force will obviously at the outset be the strongest factor, and we may imagine that the energetic factor—or rhythm—to begin with only appears in changes of state within a homogeneous field, not in real locomotion, which will appear in a later stage as a transformation of rhythmic successions, when the material formations necessary for its realisation are worked out.

The primary stage in the development of a nebula showing the highest degree of homogeneity may be called magnetic, while the second stage will be characterised by the differentiations of chemical elements, and it would then only be in the third stage that we have to do with a material nebula, in which mechanical processes come to the front.

It is intelligible that the inner foundation of the multiplicity of elements or energies in a single world is a differentiation of succession imparting to each of them

a special rhythm. But it will be understood that the life of every world-system is synthesised within a total period of time singled out from the enduring changeless background of the universal time-space. So the systems may be said to form special series of succession only related to each other by the universal time-space, in which the guarantee of a universal equilibrium may be found.

In this way we may picture to ourselves the periodic nature of the universe, the essential thought being that, when the whole cosmos is taken into consideration, the preponderance of energy gradually leading to the cooling and disintegration of the world-systems is outweighed by the constantly enduring force and life of real space itself. In another connection we have pointed out that in mechanics time is a function of space, a relation which is inverted in organic life, where space or spatial forms may be said to be a function of time. Though organic and cosmic life cannot wholly be identified, a similar inversion in the relation between time and space may be said to take place when the energy potentialised in the masses and forms of the world-systems is liberated by dissolution and seized as a medium of the eternal and uniform cosmic periodicity. The meaning of this absorption into the cosmic life-sphere is obviously a retransformation of death into life, of mechanism into organism, giving the fourth dimension—which in this connection we may call *duration*—that preponderance over the three lower ones which is characteristic of life. So cosmic periodicity may be regarded as a prototype of organic periodicity. As the matter of human bodies disintegrated by death is seized by the circulation of life and absorbed into plants, animals and new bodies, so the disintegrated matter of the world-systems is seized by universal life and made available for new systems.

In mechanical relations and relativity the three lower

dimensions become dominant. But that which we call the world-space is a means by which the fourth-dimension in the last resort gains the upper hand once more. In this sense the old Greek conception of the universe as a "zoön" (or living being), the life of which is shown in an eternal circular motion, may be renewed in our time. As Aristotle says: "To be a boundary is a function of the all-embracing, and the circular motion of the latter, which is perfect, comprises the imperfect motions, which are limited and therefore must cease. And as the eternal circular motion has no beginning and no end, but endures throughout an unlimited time, so it is in relation to other motions the cause of their beginning on the one hand and their cessation on the other. Heaven and the upper space were by the ancients attributed to the gods, because they alone are immortal" (Aristotle, *De cœlo*, II, i, p. 284, a. 2).

We may formulate our conclusions as to the world-space in the following way. It will be remembered from the foregoing chapters that four-dimensionality is intimately connected with organic as well as psychic life, the former realising itself by regularity and rhythmisation of *motion*, while the latter though transcending motion has its basis in organic life reflecting itself in the *succession* of psychic experiences. Rhythmisation and periodicity may be considered as the means by which simultaneous presence and duration are realised in the world of motion, and we have seen that in the case of the world-space simultaneous presence must be correlated to the highest motional velocity in the universe, which by the universal cosmic life is involved in a rhythm of corresponding universality. As this rhythm, representing the extreme verge of the kinetisation of energy and dissolution of mass and form, must be perfectly uniform for the totality of real space, we cannot connect

it with succession in the usual sense of the word, because succession is only apprehensible against a background of uniformity in space and time. The idea of succession is only applicable to special motions arising within the universal expansive presence by retardation, and to psychic experiences which owing to the limitation of the power of apprehension must be distributed over a series of acts and moments within an abiding simultaneity. Though the uniformity of the world-space—or rather the universal time-space—is not "rectilinear," but essentially periodic, it will be understood that if it is perfect in the sense just quoted from Aristotle, it will present itself to the cognitive powers of limited, individualised beings as the unchangeable abiding background of their experiences and acts, i.e. as the world-space to the outer sense and as eternal duration to the inner sense. In the dynamic reality of the world-space spatial presence and abiding duration are not separated but inextricably connected. There is no spatial universality and uniformity without the immutability of abiding duration. But they are separated by human cognition. The spatial presence is, as it were, projected outwards in the direction of the outer sense as the unchangeable background of spatial phenomena or motions, while the abiding duration is projected inwards as the enduring Self or the unchangeable background of conscious experiences. Thus the apprehension of the world-space on the one hand and the apprehension of the Self (or the inner continuity in time) on the other are intimately connected and dependent on each other, and the limitations of our cognition of the outer world will go hand in hand with limitations in the apprehension of our inner nature and its place in universal reality. The perfect cognition of the outer world will coincide with a perfect cognition of the inner.

Within the ocean of universal time-space the waves of rhythm and periodicity arise by retardation as the basis of spatial limitations and specialised successions (subject to retardation and acceleration). And as rhythms arise within rhythms and motions within motions, the restricted horizons of individual bodies and beings are created, dependent upon the duration of the specialised masses and forms. But within these horizons the spatial extension is connected with an inner duration of some sort, the outer motion with an inner standstill, the outer energy with an inner force. Otherwise there could be no law and form in the universe, but only chaos. Every specialisation or limitation of space involves a specialisation of time, because it is made by means of periodic and rhythmical successions—retarded in relation to the highest velocity in the universe—representing the standstill or duration of mass and form and serving as the basis of psychic successions.

CHAPTER VII

ATOMISM AND THE EXPLANATION OF MATTER

FORCE AND ATOMISM

THE attitude to the ether-problem developed in the theory of relativity should not be antagonistic to the view sketched above. The hypothesis of ether has been abandoned by many physicists. But this hypothesis refers to mechanical ether, the picture of which has gradually become a very complicated affair in physics. Many physicists, e.g. Lenard, keep to this picture as the only means of maintaining the mechanical explanation of natural processes. But Lenard does not reject the conception of a " metether " (or " Uræther ") as a medium by which space is filled and the particles of the mechanical ether compelled to fulfil the conditions of their motion (P. Lenard, *Ueber Relativitetsprincip, Æther und Gravitation*, 3 Aufl., p. 35). And this conception comes near to the view here adopted.

Einstein has shown, however, that it has become very difficult, not to say impossible, to maintain the mechanical properties of the ether. He points out that Maxwell's electro-magnetic theory of light marks a turning-point in the history of the ether-problem. The mechanical concepts, by means of which the picture of the ether was constructed—densities, velocities, stresses, etc.—were gradually abandoned as unworkable. The primary concepts of the electro-magnetic theory itself—electric force, magnetic force—began to be admitted as fundamental or existing by their own right side by side with the mechanical concepts. This was a significant change. But it

led to a dualism in which science cannot rest, and efforts were made to abolish this dualism by reducing the principles of mechanics to those of electricity. For some time, however, ether remained very much like matter. That is to say: matter was—notwithstanding its mechanical properties—a bearer of electro-magnetic fields, which was also the case with ether.

But with the work of Lorentz a great step forward was taken. All electro-magnetic activity was ascribed to the ether, while matter was regarded as carrying electric charges. All mechanical properties of ether were now eliminated except that of immobility. Einstein now introduced his special theory of relativity, by which this last mechanical property of the ether was taken away. The postulating of a stationary ether seemed to have lost its meaning, if motion through it makes no difference to any physical phenomena. Thus ether may be called a negative quantity from a physical and mechanical standpoint, and it is generally believed that Einstein rejects it altogether. But that is not the case. He points out that, if ether is abolished altogether, it must be replaced by "empty space," which is devoid of physical qualities.

But the theory of relativity is obliged to ascribe physical properties to space, because the metrical properties of it vary from point to point. The space between material complexes may be conceived as ether or filled with ether, because the properties of metric instruments are determined by it in such a way that a practical geometry is the result. Thus outer space cannot be considered as a purely indifferent container, within which things happen. It is dynamical and may therefore be called ether. But it is devoid of all mechanical properties, though it helps to determine mechanical events. And it cannot be conceived as a positive material

substance, the particles of which can be followed through time. The concept of *motion* cannot be applied to it. So this ether is a "metric field" and must be distinguished from the "electro-magnetic field," in which light as well as ordinary matter is included. Between these two fields there is a dynamical interrelation. The connection between them is expressed in the equations of gravitation.

Thus we see how science is driven towards the conception of a *negative* filling of space, which we have connected with ether, life and force. The important point, emphasised by the theory of relativity in this connection, is, that the spatial continuity, in relation to which all discrete spatial parts are perceived or pictured, cannot be identified with abstract space as a pure form. Outer space is, as we have seen, dynamical, while abstract space is purely formal and as such a-dynamic, and emptiness, infinity as well as *perfect* indifference to content are properties, which space can only have as a pure form. But in this capacity it has no real existence. It is only a negative condition of real existence.

If we try once more to clear up the relation between formal and real space, we might say that real space involves existence in a sense in which formal space does *not* exist, that is to say, a dynamic existence. But in this existence formal space must enter as an implied feature of our presupposition. In real space, then, formal space must be affirmed as well as denied, which in the first instance may be taken to mean that it is denied as formal and affirmed as real or dynamical. Now the aspects of formal space, which are affirmed in real space, may be characterised as extension and emptiness. But neither of these aspects can in real space be infinite and absolute, because in this case they would devour and frustrate all material formations. For it

must be remembered that as *real* the absolute extension and emptiness could not be indifferent to its contents as formal space is. It would be active, and as absolute its activity could leave no room for an activity resulting in the building up of masses and forms. Consequently, though extension and emptiness may be prominent aspects of real space, they must nevertheless be checked and counteracted by a dynamic principle of opposite character, producing form in the formless, rest in motion, substance or contents in emptiness, and making the indefinite definite.

Thus the extension and emptiness of formal space are not so perfectly and absolutely affirmed in the real, as not to be counterbalanced in the last resort and the long run by a dynamic principle of substantialisation and formation. Now in the case of the world-space the activity of the latter principle may be considered as minimal. But though it will reduce form and substance to a minimum, it will for long distances and long times produce deviations from that indifference which is characteristic of formal space. And if we think of the uniform continuity which the world-space must have as a cosmic life-sphere, it will easily be understood that the *indifference* of formal space is realised much more perfectly in the mechanical relations between isolated solid bodies than in the continual extension of the world-space. No inner dynamic relation seems to connect such bodies, for instance, as a multitude of stones. Their coexistence is a mere "juxtaposition." But the latter can only be regarded as an approximation to ideal spatial indifference. And it presupposes all the material formations by which solid bodies are formed.

Of course mechanical pictures abstracted from relations of a solidified reality have largely been universalised and used to explain physical reality as a whole.

The relations between the atoms—or last unities of physical reality—have been conceived as essentially mechanical, and even where such mechanical explanations have been checked by dynamical principles, the tendency has nearly always been to consider the atoms in relation to an indifferent, empty and therefore mechanically conceived space, not in relation to a dynamic spatial continuity. The result of this has been, that the discreteness of matter has been unduly emphasised at the cost of its cohesive qualities and the dynamic continuity of space. We must, however, carefully distinguish between two aspects of real existence in space, the one appearing when the space-filling reality or dynamis wholly enters into the spatial divisibility and the mutual separation or indifference involved in it, and the other appearing in the overcoming of this separation by means of a dynamical and equal presence in the parts or points in which the spatial divisibility is realised. These two aspects may be more or less pronounced in relation to each other, but the one is never wholly without the other. The predominance of extension and energy in physical existence is however shown by the fact, that the tendency towards divisibility, dissolution and repulsion always in the long run gains the upper hand in all physical *specialisations* within the world-space, though it is checked and limited by the latter as a totality.

It must be remembered that the dissolution of matter in atoms and electrons is no explanation of matter as such, because these last particles are supposed to be material themselves in so far as they manifest the material quality of " mass " or inertia. The advantage of atomistic conceptions is only that they facilitate the explanation of concrete material phenomena or changes. But with respect to " matter " they only mean that the sensual material continua are replaced by a

multitude of invisible material particles. Mass, or inertia, is not eliminated by its atomisation or reduction to a minimum.

Atomism is thus no explanation of matter, because it presupposes that which is to be explained. Matter must either be accepted as an ultimate fact in nature, or it must be explained *dynamically*. But if the mass or inertia of the atom has to be explained dynamically, how is it possible to do this by the same kind of dynamis as that by which its spatial dynamical relations to other atoms are determined ? Natural science has to do with the fundamental dualism of matter and force (or energy). But we do not evade dualism by explaining matter dynamically. It is impossible to explain physical reality fully by means of a dynamical *monism*.

The most renowned attempt to explain matter dynamically is that of Kant, who in the second part of his work *Metaphysische Anfangsgründe der Naturwissenschaft* tried to construct matter by means of two opposite forces : repulsion and attraction. Of course he could only look upon matter as a phenomenon, not as a *Ding an sich*. But he based his construction upon the presupposition that matter is the movable something by which space is filled. The filling of space is, however, not a result of passive existence, but of a repulsive force or force of extension, which in all specialisations of matter must be present in a definite degree, below and above which an endless series of degrees may be imagined. If this repulsive force were not counteracted by an opposite force, matter could not be kept within definite limits, but would vanish into the infinity of space. The antagonistic force by which repulsion is checked is of course attraction, and if this force were the only one in the universe matter would be concentrated into one point. Though Kant rejected atomism, which has been so

fruitful as a basis of empirical scientific work, and adopted the conception of material continuity, his theory has played an important part in the discussions of science and contributed much to the elucidation of the problem.

There is, however, a fundamental question which was left undecided by Kant. He constructed matter by the co-operation of two opposite moving forces and the variations possible in the relation between them. But forces are commonly understood as belonging to something real—a substance so constituted that the forces necessarily spring forth by its relation to other substances. Of course the substance of natural science is matter, and so the construction of Kant seems to presuppose what it should construct, namely, matter as a necessary subject as well as object of repulsion and attraction. Probably Kant tacitly presupposed a real something implied in the category of substance without entering into a further discussion of its nature. Obviously such a discussion would have involved an investigation into the causes leading to the specialisation of *different* material substances within space. But this question he refuses to discuss, because it involves an appeal to experience and cannot be solved *a priori*. He suggests, however, as possibilities, that the different material substances may be due to different *degrees* of co-operation between attractive and repulsive force, *or* that—conversely—these degrees of co-operation may be caused by *an original difference between the substances*. That is to say, the quantitative variations in the relation between attractive and repulsive force may be due to original qualitative causes.

His treatment of the subject is, however, purely formal, and his object is to disprove the atomistic and mechanical conception of matter.

Dynamic Atomism

The question how far the conception of substance or "stuff" can wholly be eliminated by a dynamical explanation of matter is a disputed one. Professor Edmund König, whose work *Kant und die Naturwissenschaft* has gained a high reputation, is of the opinion that this conception is indispensable in natural science. The attempt to reduce matter to force must in his opinion be fruitless, because the conception of force is originally founded upon a synthesis of the conceptions of substance and cause and cannot evade the consequences of this origin (Edm. König, *Kant und die Naturwissenschaft*, pp. 151 ff.). Activity without an acting something is impossible. On the other hand, the view that stuff or matter is nothing but force has been ably defended by E. v. Hartmann in his thorough work, *Die Weltanschauung der modernen Physik*, and his explanation of matter may perhaps be regarded as the most successful attempt which has been made to connect dynamism with atomism, which of course has become necessary in modern times owing to the preponderance which atomism has gained in natural science.

Hartmann looks upon the inorganic world as a system or mutual interrelation of atomic "dynamides," the activity of which is centred in a point. This activity is either repulsive or attractive, and it radiates throughout the infinity of space, so that the dynamic sphere of each atomic centre fills the whole universe, though in different degrees. But in relation to each other these centres are *excentric*, i.e. the points of dynamic radiation do not coincide, but are situated outside each other and move about in space. Thus there is no empty space. The whole world-space is filled *dynamically*, though the filling of space with *matter* is limited to those areas,

where the grouping of the dynamides is close enough to cause the phenomenon of resistance against intrusion and the reflection of light.

The theory of Hartmann is based upon action in distance, for which he gives an acute defence. Every dynamide acts everywhere *except* in the centre of its activity. If this centre is the "seat" of the activity, and if this seat is regarded as the place where the dynamide is in space, we come to the curious conclusion that the dynamide acts everywhere except in the place where it is. This is, however, according to Hartmann not the correct way to state the case. On the contrary it must be said that the dynamide *is* wherever it *acts*, i.e. in the whole universe except in its centre.

But however the case is formulated, the excentricity of the dynamides within space cannot be accepted as an ultimate fact by a dynamic explanation of matter. And the question, what is the reason of this excentricity, is fundamentally a repetition of the question suggested above about the reason for the specialisation of *different* material substances within a dynamically conceived spatial continuity. According to Hartmann the spatial extension of physical reality is to be regarded as an attribute or a result of the activity of the dynamides, while the latter in themselves are non-extensive and superspatial.

But how can non-extensive centres of force, unconscious and immaterial, produce extensive effects, and how can an "absolute" spatial continuity be possible otherwise than as a qualitative extension, i.e. as a union of quality and quantity? Other difficulties would also have to be solved, e.g. the distribution of the attractive and repulsive forces and the variations in the relation between them. According to Hartmann there are two antagonistic groups of dynamides, the one repulsive and

the other attractive. But then the attractive dynamide has to be endowed with a repulsive "covering" as a protection for its excentricity. Various attempts have been made by others than Hartmann to formulate the relation between the repulsive and the attractive force. The hypothesis of Fechner, for instance, is that repulsion is transformed into attraction in accordance with the number of dynamic centres which are combined into a common activity. But the law which he tries to formulate for this transformation has an arbitrary character, and what determines the combination into a common activity?

Hartmann, as well as other dynamists, tries to explain matter by means of a purely *quantitative* conception of the two fundamental forces—their degrees of intensity—and this leads to rather questionable attempts to reduce all qualities to dynamic quantity. If attraction and repulsion are considered only from a quantitative point of view, we can only expect that they will mutually reduce each other to zero, i.e. absolute sterility. But matter in the modern sense of the word has a qualitative structure—realised by means of rhythms—and this qualitative structure can only be explained if at least one of the two fundamental forces is inherently connected with quality. Quantity (or extension) may be regarded as the dominant feature in physical reality, but quality cannot wholly be eliminated away or reduced to quantity, and there can be no doubt that if we are to choose between the two fundamental forces as representative of quality, the attractive force must be preferred (attraction having the character of force and repulsion the character of energy in the sense explained in a foregoing chapter).

From this point of view, then, repulsion or extension can only be a quantitative means of realising that quali-

tative filling of space and time in which the excentric specialisation of material substances consists. As we have seen, the relative emptiness of the world-space cannot be considered as wholly destitute of quality. As *pure* quantity it could have no real existence. But in relation to the material specialisations taking place within it, it may be regarded as representative of a universal, uniform extensive quantity, by means of which material qualities are realised. As the primary effect of such realisation is mass, and as the mutual interrelation of masses in space is invariably connected with attraction, the latter must have an inner relation to the qualitative specialisations in space.

Attraction and Repulsion

The origin of matter, then, involves a quantification of qualities, and we need not evade the consequence that these qualities in the last resort have their home in a cosmic psychic sphere. But their realisation within the sphere of motion means that the latter is interpenetrated with that motional *rest* which is the physical basis of psychic activity and cognition. We may look upon the specialisations of material substances as quantification of qualities or as qualification of quantity (if the process is considered from the standpoint of uniform extension). In any case this mutual interpenetration involves a *definition* of space and time. The material substances make certain areas of space and time *their own* by a special geometry and rhythm. Such qualitative appropriation of space and time is inextricably connected with real existence in it. Dynamism is right in contending that the material filling of space and time originally cannot be deduced from a mere quantitative, passive existence in it. It

must be due to a qualitative force, though the material products of the latter in the long run may become a prey of quantitative divisibility and repulsion. But in the constructive apprehension of matter from dynamical points of view sufficient attention has not been paid to the definition and appropriation of space and time, involved in material specialisation.

Attraction can only be understood as essentially a *negation* of spatial difference, distance and divisibility. Within the primary spatial expansion it must therefore be looked upon as the aspect by which its continuity is maintained, while repulsion will be the aspect of the same reality, by which its continuity is constantly differentiating itself spatially from point to point in all directions, producing what we might call a gliding *contact* between the different spatial points. Thus we have in repulsion an affirmation of direct contact, which in attraction is overcome from the inside, as it were. In picturing the original spatial expansion it is impossible to detach these two aspects from each other. In space or rather time-space they form a unity, in which action in distance (attraction) and contact-action cannot be kept wholly distinct. It is only when material condensations and divisions are considered that the contact-action steps into the foreground as the more perspicuous and intelligible means of explaining spatial changes. But material substances have in addition to their outer discreteness an inner cohesive aspect, which is connected with attraction.

In mechanical matter or mass, which is formed within space, we note the fact that the only force by which it constantly acts outwards is attraction, while repulsion seems reduced to play the secondary part of preventing spatial interpenetration of different masses. Of course repulsion plays a prominent part in all radiations. But

the latter may at least be considered a negligible quantity in considering solid bodies. In so far as attraction and repulsion enter into the constitution of the mass, repulsion must be regarded as subordinated and fettered by attraction. It seems reduced to a sort of passive resistance while attraction is the real living activity. It must be remembered that attraction, not only in the relation between the masses, but also within the mass itself, is predominant in the form of cohesion, reducing the impenetrability of matter as the repulsive aspect to a negative position. And in the case of mechanical motion produced by the pushing power of the mass, the repulsive power of the latter is determined, not by its spatial extension as such, but by its weight (or gravity) in connection with its velocity.

So repulsion has the character of a subordinate or suspended moment in the formation of matter. It would not be correct to say that mass is a compound of attraction and repulsion. Rather it must be said that attraction, by subordinating and binding repulsion in matter, manifests itself in space to a degree which can be formulated quantitatively. The binding of repulsion is limited to the mass itself, while the attractive power manifests itself throughout space. Though attraction implies a *negation* of space as the expansive power, it can only manifest this negative power within space by *affirming* the limited and defined spaces of the single masses between which attraction works, or in other words by clothing itself, as it were, with certain quantities of suspended and transformed repulsion. So the formation of masses in different areas of space, and the manifestation of a mutual attraction between them, are only two aspects of the same process. And as repulsion and energy must be identified, this view is fully in accordance with the thesis that the mass of a body and its contents of

energy are identical, and that the inertia of a body will be equivalent to its gravity.

Regarding the theory of gravitation formulated by Einstein, it must be remembered that it does not give a real *explanation* of gravity. Its aim can only be to give a description of it in quantitative terms, making it possible to calculate exactly the motion of a body (e.g. a planet) under the gravitative influences of the masses. But philosophy cannot acquiesce in the formulations of physics. It must try to consider them in more comprehensive connections. And the pictures of the fields of gravitation produced by the descriptions of Einstein is consistent with the view here set forth. If we consider attraction in the light of the foregoing it will be seen to involve what may be called a *curbing of space*, which must be more predominant in the special fields of gravitation belonging to the various world-bodies than in the world-space as such. Thus we get a picture which two-dimensionally may be expressed in the following way: the world-plane as a totality is an enormously extended globe overspread with a great number of little spheres or contractions, in the centres of which the stars are situated. Perhaps it might be possible in this connection to understand light better as a repulsive motion correlative to attraction and its working in the building of masses and forms.

However this may be, attraction as negative in relation to spatial expansion must be considered as a manifestation of the aspect of intensity, with which the extensity of spatial existence in its variety of forms is always connected. A union of extensity and intensity is necessarily implied in real space as well as in every material substance which can be separated from other substances, and as the extensity is accentuated in the excentricity of the parts or particles, so the intensity is accentuated

by the unity, coherence and continuity of the substance. In addition to a multitude of excentric points (atoms) moving in relation to each other, there is also in material bodies a point of gravity, in which the excentricity of these points and the extensity of the body as a whole are relatively overcome. The continuity of matter is no less dynamic than its discreteness. But as it hides itself behind the discreteness and its spatial interrelations, presentable to the outer sense or sensual imagination, the tendency to regard it as a negligible quantity and to interpret material phenomena entirely in the terms of discreteness is easy to understand. In the discreteness and spatial interrelation of particles the repulsive aspects of space gain a positive, relatively independent existence, in relation to which the continuity only remains as an inner negative force.

Thus we may look upon continuity as the immaterial in the material, the inner in the outer, rest in motion and the intensive aspect of extensive existence. From the standpoint of the outer sense continuity might be represented by negative numbers outweighing and counterbalancing from the inside the positive numbers regarded as representative of the material discreteness. The spatial 0 or zero would then be a point of equilibrium between the positive and negative aspect of material existence. To reach the real source of continuity we should then have to pass not only beyond positive discrete materiality, but also beyond space in its purely neutral form—the point of equilibrium—to a dynamical reality, which though related to space and manifested in it, is related to it in a way opposite to that of discrete materiality. If this material and spatial negativity of *active* continuity is kept in mind, it will be intelligible that it cannot manifest itself *directly* in any repulsive manner, i.e. as the resistance of one positive material

substance against another, for instance, as the resistance of the air against a body moving in it. It must manifest itself indirectly by the organisation of repulsion.

Material discreteness is a condition of motion, and in so far as every discrete material substance, though it may be only an electron, has continuity in itself, it follows that continuity—though differentiated and broken up—is a presupposition of motion. And the more continuity is broken up, the more motion comes to the front. Motion is therefore more intimately related to repulsion than to attraction. In itself motion is not a creative, but rather a disorganising process. It is antagonistic to force, by which mass and form are created, which means that it is also antagonistic to quality as that which rests in motion, the enduring in the motional changes. Mere motion of discrete particles would only be chaos, and force can only manifest itself by keeping motion in a subordinate place as a means of organisation. This is done by the potentialisation of energy. But within the sphere of motion it is not possible to bring *all* motion to a standstill, i.e. to bring about a *perfect* potentialisation of energy. Thus all special creations of force must in some respect or in the long run become a prey to energy.

Time and Substance

If we now once more consider time in relation to real dynamic existence, it will be remembered that the reality of time—as in the case of space—involves a negation of it in its purely formal, incausal and indifferent aspect. The affirmation of time as real implies a dynamic definition of it, by which its discreteness—or succession of present moments—is definitely related to its continuity or endurance. But the enduring continuity may in this

case be a spiritual as well as a material substance. It may be a mass or form, the endurance of which may be measured by its inner (rhythmic) vibrations and by its motion as a whole in relation to other substances, or it may be a spiritual substance (or at least an analogue of it) estimating its own endurance by means of the distinguishable succession of its presentations and experiences. Thus time has a wider range as a form of dynamic reality than space, which can only as a vehicle of motion enter into real existence. In the activity of consciousness time has a domain of dynamic reality apart from motion, but correlated to it as a basis of its successive and cognitive acts.

We have seen that life and force are a source of substantialisation within the world of motion, whether we have to do with the finest and most universal substantialisation in the world-space or with individual specialisations. Now it is evident that substantialisation means endurance or continuity in time, which in the sphere of motion involves the subordination of motional changes as a sort of vehicle, by means of which the continuity in time is expressed and maintained. In every substance space is a vehicle of time or endurance. Of course time may—as we have shown in another connection—be reduced to a mere vehicle of space: when we consider motion from a purely mechanical standpoint as a result of a push, the time involved in it appears only as a means to realise the spatial continuity of the motion. But such mechanical motions or relations have no substantialising force. They are rather connected with a tendency to desubstantialisation and do not exhaust the possibilities in the relation between time and motion. Another aspect of this relation appears, if instead of considering the motion as a transitory isolated event—a calculable effect of a mechanical push—we consider

the subject of motion: the material substance or form. In relation to time this substance is something enduring, which remains the same during a certain period of time. As subject of motion it changes place without itself undergoing any perceptible change. Or if we consider it in relation to itself as an aggregate of revolving electrons, we know that the identity of this aggregate in time is a result of the fact that the invisible movements of the electrons are *repeated* moment after moment. Thus the *rhythmic periodicity* of motion is a medium of substantialisation, a means to unite moving parts into wholes, maintaining identity in time.

As is well known, substance means identity or endurance in change. That is to say, substance is conditioned by change. But in some respect or other it must remain unchanged in the midst of changes going on within it or in its relation to other substances. This unchangeability is in the sphere of motion realised by repetition of the same movements within the same periods of time. What makes the solar system a unity in time notwithstanding the plurality of its bodies and their motions, is the regularity and rhythm of the latter, and it is evident that the continuity in time produced in this way is something very different from the continuity represented by the mechanical principle of inertia: that the motion of a body remains unchanged in velocity and direction, if unaffected by influences from the surroundings. The purely passive continuity represented by the principle of inertia is in the case of rhythmic periodicity replaced by a continuity of an active character. And while the principle of inertia is a principle of isolation and disintegration, rhythmic periodicity is a principle of combination and union. Thus it will be understood that motion, which in the case of purely mechanical and indifferent relations can

only be a medium of disintegration, energy and chaos, by rhythmic periodicity is made the basis of a substantial identity or continuity in time. And such substantialisation means the subordination of motion to time or endurance. Time is no longer a passive subordinate moment in the spatial continuity of a uniform and rectilinear motion, but rather an organising power, by which a simultaneous enduring presence within the sphere of motion is realised. The point of gravity is removed from the mere spatial continuity to continuity of time, maintained by a subordination of motions and the spatial relations between them. No further analysis should be needed to show the inner relation of substantial endurance or continuity in time to attraction or force in opposition to repulsion or energy. Time in the form of rhythm, periodicity and regularity is a vehicle of the intension, by which extension or space is "curbed" not only in its primary capacity as world-space, but also and more especially in the systems and material substances, which can be considered different in relation to each other. As all-embracing and universal the substantialisation is restricted to the uniformity and rarity of the world-space, but in the material specialisations the degrees of density are intensified.

But the material substances or combinations formed in this way are not eternal or changeless. Though they may last for long periods of time, they become a prey to disintegrating tendencies. And when this is taken into consideration it will be understood that the changes taking place in time may go in alternative directions: substantialisation or desubstantialisation, formation or dissolution.

The implications of time coming to light in this connection may be explained in the following way. It may be convenient for practical purposes to characterise time

as a succession of moments, in analogy with the characterisation of space as co-existence of different extensive bodies. But this is only a paraphrase of the terms time and space in their ordinary meaning, not a definition of their implications. In respect to time it is evident that it always involves a differentiation of past, present and future, and that its implications can only come to light by a correct appreciation of the relation between these three successive moments. Now if time is considered from a purely abstract and formal standpoint, the attention will dwell upon the fact that these three moments are constantly replacing each other, and in so far can be identified. What now is present will in the next moment be past, and what is now future will in the next moment be present, etc. Thus the so-called one-dimensionality of time, represented by the drawing of a line, is realised, and the real meaning of the difference between the three moments is effaced. The continuity of time is translated into a mere spatial continuity.

By abstraction the relation between the three moments thus becomes one of indifference. But when time is considered as a vehicle of dynamic realisation this indifference cannot be maintained. The implications of time applied to such a realisation will best be understood if we define the time-process as a transformation of the future into the past by means of the present. Time is not an unmediated streaming into the future out of the past. The present always stands between the two, and through the present the future may influence the process in such a way that it may be as correct to speak of a flow of the future into the past as of the past into the future. If the mediating function of the present is reduced to the zero of pure passivity, the process will have the character of a blind and necessary continuation of the past into the future, as in the case of a purely inertial

motion. But the more the present gains in importance and richness, the more the past is reduced to a medium for the realisation of future possibilities. The present can only be present by a negation of the past as "no more" existing in relation to the contents of the "now," and by means of this negation the future in the form of alternative possibilities may influence the course of the process. So the present may be compared with a gear, by which the direction of a moving boat or automobile is intelligently determined. Time is not time without a future, and by virtue of the future the continuity in time leaves room for an element which is absent from the pure continuity of space—the element of the indefinite, the undetermined, the unrealised. There is an inner connection between future and the concept of possibility, while reality is connected with the present and necessity with the past. From this point of view it would not be incorrect to say that time is a process by which possibility is transformed into necessity by the mediation of reality, though the terms must here be understood in a special sense. Of course the form in which the future, or the possible, gains an actual importance for the time-process is the unconscious bent or tendency of instinct on the one hand, and the conscious purpose on the other, both of which imply a mode of existence different from that which is represented by mere spatial existence and identity.

It must be remembered that time is not only a medium of endurance or *continuation* of the past in present and future, but also and pre-eminently a medium of change. Now change means a *transformation* of an existing state of affairs into another, and this involves the functioning of the present as a medium of a future different from the past. A change is always judged in relation to a *meaning*. It is either accidental, i.e. meaningless, or it has

a meaning, in which case the change is a moment in the realisation of a *purpose* or an idea. Accidentalness or purpose are the alternative forms in which the future becomes significant to the actual time-process. By both these concepts we judge the time-process from the standpoint of the future, not from the standpoint of the past. That a change is accidental does not mean that it is uncaused by the past, but only that it is unplanned. It happens without a purpose or meaning, by which the future is made a dynamical factor in the present.

Now it should be evident that a perfectly accidental and meaningless time-process would be devoid of that substantiality, which is a condition of consistent cognition and work. Intelligibility and workability imply meaning and inner coherence, which are dissolved and annihilated to the extent in which the time-process becomes the prey of pure accidentalness. Meaning or idea is that which gives to a concatenation of motions an enduring unity and simultaneity of presence. In so far, then, as the time-process may be the explication of a meaning or only accidental, it is either a vehicle of substantialisation or desubstantialisation of a *telos* or an *a-telos*." It may be a means to create a reality animated by an enduring idea or it may be a means to dissolve and disintegrate such a reality. The best designations for these two alternatives involved in the time-process will perhaps be: essentification and nihilification, essentification meaning the substantialisation of a spiritual idea (the quantification of a quality) and nihilification the antithesis to that process: the reducing of a more or less substantialised reality to "nothing." But it will easily be understood that "nothing" in this connection can only mean that maximum of repulsion, disintegration and kinetic energy, which involves the effacement of every specialised or individualised existence

in the world-space. Owing to the predominance of energy or repulsion, which is characteristic of the sphere of motion, the substantialisations within this sphere can only have a limited endurance, nihilification in the long run gaining the upper hand over the substantialisations. Immortality and eternity involve a question, therefore, which must be treated from the standpoint of spirituality in its relation to materiality.

Printed in Great Britain by Hazell, Watson & Viney, Ld., London and Aylesbury.