

A New Dynamism for Philosophy.

Chapter 3.

Time and Space.

Key Questions. *What is Time, the passage of time and how are we to understand past, present and future within it? Why does Time travel in just the one direction? What is Space? What is the relationship between Time and Space? Are Time and Space real and objective? What are the implications of the relativity of time and space for our understanding of them?*

This book set out to tackle some of the central problems of philosophy with the contention that they have only emerged from questionable assumptions about consciousness and reality. My central argument continues to be that they produce disposable problems and we don't need to expend too much of our lives pondering over them. By way of a contrast in this chapter, I want to scrutinise the dimensions of time and space. However characterised, whether as categories or forms or things, these represent fundamental ways in which reality is perceived or presents itself. Understanding and defining them consequently appear to me always to represent a legitimate area for philosophical debate, even if the perspective of a particular philosophy finds them ineluctable.

Time is a difficult concept, and perhaps this is why relatively little philosophy has been written on the subject. "What is time?" is often asked by children as young as three, and it is unlikely that they receive anything like an adequate answer. Difficulties arise when we try to force an understanding of time in spatial terms. A major puzzle is the passage of time, where the present appears as the crest of a wave, converting all before it in the future to the past and history. Whereas we seem to accept a representation of past and future as a calendar or continuous framework with spatial dimensions, we have trouble accepting and explaining a constantly shifting present that cuts through it. What is this paradoxical process by which future becomes present and past in turn? Just as puzzling is Time's relentless forward movement. In space a movement is reversible, but not so in time. The passage of time and the asymmetry of its direction undermine the validity of a spatial model. Many philosophers pre-Kant have found space less problematic as an objective setting for

reality, but the accommodation of time seems to pose special difficulties, and has prompted a subject-based tradition, where the passage of time is seen as the product or projection of a creative consciousness. In consequence, these philosophers share a static view of the temporal process. They no longer accept that time is ultimately real, and temporal phenomena, such as change are treated as appearances or illusions,

Time is often designated by a proper noun and refers to the sum total of events comprising the history of the Universe, stretching from the beginning to the end of Time and containing everything that ever had an existence or occurrence in time. So it will help our discussion to remember to distinguish Time as the cumulative process of history with time as the dimension that lends an attribution to each occurrence or event.

A dynamic understanding of time has an equally long and distinguished history, traceable back towards Aristotle and beyond. On this view there is a difference between past and present as real on the one side, and future as unreal on the other. The passage of time becomes a cumulative process by which the number of real events augments an ever-expanding history. So time is bedded back out into reality, but the puzzles remain as to why the process should be happening at all, why it should travel in only one direction, and how it is we are able to position and order time's dynamic processes into static chronological categories. Simultaneity and change are just two more concepts that seem to presuppose a passage of time or to fix a position in time, and yet understanding these is not easy. If the passage time is in fact solely defined by the occurrence of discrete events, for instance, then how are simultaneous events even conceivable? And how can we even begin to understand the passage of a dynamic time without being able to locate fixed points within it? These are definitely questions for the grown-ups.

Einstein's contributions to maths and physics have complicated the philosophical understanding of these questions. It undermined the near universal assumption that the passage of time has moved at a constant rate and the extent of space possesses fixed grid-like dimensions within which the history of the Universe has been enacted. His demonstration that the conditions under which both are measured will influence the results obtained have reintroduced a subjective element into our understanding of both time and space, and restored the individual observer into a central position as an arbiter on what is real and not real.

One clue to the new dynamic understanding of time I propose can be found in the dynamic process itself. This version rejects the idea that reality is composed of a succession of states of matter, each characterised as a spatial arrangement of particles, and each impelled towards its successor by the application of some external force. Theories based on this idea assumed an essentially stable or inert foundation for the material universe. They then build an understanding of reality as a limitless spatial form in which successive rearrangements of matter lend content to a relentless and unbounded passage of time. A dynamic alternative locates both force and matter in the pulses of energy comprising the atom, and conceives stable material forms as resulting from a balance or containment of the pressures that they exert upon each other. Accordingly time represents the more vigorous and fundamental of reality's features, and space exists within it by virtue of the network of relationships that temporal impulses produce through their interaction.

It is not necessary for minute pulses of energy to exert influence on others as a guarantee of their existence. A magnetic field may lie undisturbed for instance. Nor is there a need to insist in a Newtonian spirit that a pulse of energy must persist indefinitely so long as it remains unopposed. They might just appear and expend themselves, dying out in an instant. They must do this unobserved, of course, since observing anything necessitates influencing its object and the energy it gives off. Even the sight of a distant star requires the eye to intercept and divert some of the light waves it transmits. It is easy to suppose that we only see the light emitted by the star, and do not influence the star at all. But then we are conceptualising the encounter in such a way that detaches us from the star. So conceptualised we now see the light produced by the star and no longer see the star. Only for that reason do our observations fail to influence it. Isolated energy pulses are certainly conceivable as fields of potential influence, the nature, strength and direction of which we can ascertain by engineering encounters with them. Where encounters result a boundary forms. A boundary in time that may stabilise and assume spatial dimensions.

Time consequently emerges from the relationships generated by influential dynamic encounters. Certainly it should not be regarded as some pre-existing tunnel within which events occur and along which they travel. Only once events interact can boundaries be defined in temporal terms. Isolated dynamic events are timeless and

rather like points without dimensions, until they exert influence upon other events. Conceivable perhaps, but an understanding of time cannot be built from them alone. If we do place them in time it will be in a context already supplied by events with a temporal location. The only energy impulses with an independent temporal dimension are those with boundaries formed by the influence they exert or are capable of exerting on others.

This proposal for a dynamic understanding is markedly different from alternative theories. It doesn't insist that all events must of necessity possess a temporal dimension for instance. It subordinates time to the occurrence of a particular type of event and so assists the formulation of a definition of time. It also breaks the vicious circle that appears when the concept of change is introduced alongside that of time. Time is often referred to as the dimension of change, but it is unclear whether time is needed to make sense of change, or change is necessary to make sense of time, or whether perhaps we need something to make sense of both. I suggest that we can develop the concept of time independently of that of change. Change is not necessarily a temporal concept. At a more general level it characterises variation, and this may simply represent differences in colour or texture over the surface of an object. Rivers change along their length, and the atmosphere changes at different altitudes. So there is a spatial dimension to change. We might regard this as a metaphorical representation, but I suggest we ought to be treating it as rather more literal. I have proposed in the opening chapter that change signifies variations in what we tolerate as aspects of one phenomenon, be it object, event or property. The scope for change will be what our concepts allow. So whether events represent change in an object, or the replacement of one set of objects by another, is something we employ concepts to help us decide.

This new dynamism I propose appeals specifically to interaction or influence as the source of temporal relationships. Their source is not isolated objects or events, be they static or changing. The concepts of change and time are related, but only a particular type of change is pertinent to our understanding of time. The process of change and the passage of time are not one and the same thing. Here is a shift of perspective that allows the new theory to embrace both static and dynamic components of the traditional theories of time. A possible difficulty this new dynamism must face is that of distinguishing an event and the scope of its influence. Surely again this is an area regulated by concepts. So does time the concept depend upon the way we schematise things?

A new dynamism sees no difficulty here. Where conflict can be located between the forces generated by the driving energy of reality, then this suffices to demarcate separate occurrences and to locate interaction or influences. If interaction and influence underpin our conceptualisation of everything, as dynamism suggests, then time and reality remain independent of our conceptualisation of them. It is true that we conceptualise things in different ways to suit our purposes. We refer to a river as a uniform entity for instance when eddies and currents are internal influences, or the result of influences, that betray a more temporal passage to a river's existence. The influences that sustain our familiar world of objects and events are real enough, and so is the change we normally recognise as occurring there. It is just that it doesn't always suit our purposes to focus upon them in our conceptual scheme of things. Dynamism can be helpful because it goes further and recognises a difference between influences that imply temporal relationships, and changes that may not, and this may solve some of the riddles that time has washed up.

Dynamic theories of time can explain the passage of Time that appears to move in only the one direction. Often referred to as "the arrow of time", we are all aware of its unwavering forward march. We can try recreating situations, reversing or repeating manoeuvres, but will never undo what is done and reverse the passage of time. Every event is separate and merely extends the passage of time on each occasion of its reappearance. As fundamental elements of the dynamic process, there is only one direction in which a number of dynamic events could relate to one another, and that is as an expansion that implies a succession. Simultaneity cannot be accommodated independently of this process and can be conceived only within a supplementary spatial framework. If time is more fundamental than space then it has no scope for an alternative direction. There is nothing in relation to which any change in time and its direction could be construed. So time travel is inconceivable. Dynamism leaves us rooted in the present!

Somewhere between the beginning and end of Time lies a constantly advancing present. Finding the present poses something of a problem for static theories of time, and these include materialists amongst their number. Whilst it appears easy to construct a comprehensive representation of the passage of time back to its beginning, it is more difficult to justify locating the point on a scale where we are now. Simply indicating the events around us which are

presently taking place begs the question. How do we know that the occurrence of these events, or the position marked on this calendar, is indeed the present? The most recent of actual events perhaps, or maybe the last in causally linked chains of events? These beg the question too. A static representation is too detached from the passage of time to be able to lend any more significance or reality to the present than to any preceding or succeeding position. The idea of the Universe and its history as a well-oiled machine has no room for an additional and elusive present to run through its rollers. Static theories presume rather than explain the passage of time.

Dynamic theories of time can stray too far in the opposite direction and have difficulty recognising a passage of time independent of the present. Experience-based theories of consciousness are especially vulnerable to the charge that everything that is experienced must be immediate and in the present, including memories of the past and visions of the future. No means can be devised to break out of experience and supply an independent perspective upon the passage of events. Just as they lead inexorably to solipsism for the self, experience based theories entrap their adherents into a perpetual time lock of the present.

If anything encapsulates the failure of philosophy to get to grips with time and space it is the tendency either to characterise time in spatial terms, or to attempt the reverse with space in temporal terms. Broadly speaking these are the static and dynamic positions respectively. A successful theory of time needs to recognise both the reality of a passage of time together with the immediacy and proximity that the present represents within it. A new dynamic theory attempts to reconcile these conflicting requirements with a definition of the present. The fundamental components of a dynamic universe are pulses of energy that exert forces to produce encounters or occurrences in time. The present is simply represented by the sum total of the active energy or the potent forces that are in operation. Nothing could be simpler. They define the present moment. When there are two or more, then they are simultaneous. They are not the energy and the forces in operation at a given time which has somehow been determined independently. Their reality and validity defines that given moment in time. The Sun has remained a source of energy for a long time, for instance, and its persistence is all that is needed for it feature as an ongoing part of the present. Defining both positions and relationships in time now becomes possible.

I have suggested that time is the more vigorous and fundamental of the dimensions to the Universe. A new dynamism is incompatible with a static position that places the three dimensions of space alongside it. Space is the stage for a subordinate set of relationships within time, representing an additional axis that cuts across the passage of time. A clue to a dynamic theory of space can be found in its treatment of sensation and perception. Underpinning a distinction between the two has been the suggestion that the objects of perception have a spatiality that we can locate because we have bodies that enable us to intervene in the relationships that hold between them. We are able to perceive objects in spatial situations because dynamic encounters can stabilise to become objects and situations, and form relationships with each other. The scope for other objects or phenomena to influence these relationships in turn lends them a new and spatial dimension. The objects and situations are temporal because they exist in time, but the new influence they exert introduces a flexible and reversible element into their relationships that amounts to mobility. Temporal relationships and spatial relationships do not emanate from different spheres. The spatial phenomenon is the temporal phenomenon existing under conditions where positional or displacing influences come into play. Space is the arena for their operation. It is not a pre-existing space marked out as an arena for positioning and displacement. The spatial arena is defined by the scope that exists to influence the relationships between objects. Typically, it is the scope to prise objects apart, or bring objects together to order them into new sets of relationships. It is the power to displace objects that defines the extent of space. The proposal may resemble circular reasoning, but it is any influence that can be exerted at this level that necessarily assumes the form of spatial.

An interesting implication of a dynamic theory of space is that both space and our apprehension of it are fundamentally three-dimensional. Its three dimensions are not cobbled together from the other two. A perceived situation may contain nothing more than a simple object against a plain background. Its object becomes accessible to perception because its relationship with its background can be altered, either by moving the object or by a shift in position from the perceiver. Only in a fully formed three-dimensional space is this intervention possible. Three-dimensional space is space in its most basic form. A two dimensional representation is a distillation, and is perhaps best understood in terms of the way in which objects appear from a fixed viewpoint. Confined to a two dimensional plane, perception cannot proceed at all. A great deal of Empiricist inspired

philosophy has sought to construct a three-dimensional material reality from the scrutiny of what it construes as basic two-dimensional experiences. Although now largely abandoned, the project was doomed from the moment it placed a two-dimensional representation between our perception and the reality it sought.

Since space runs within the passage of time, it seems plausible to suggest that it should possess an additional dimension. Possessed of just the one, space would run parallel to and fail to be distinguishable from time. A hypothetical universe might just be conceivable in two dimensions. Composed exclusively of sound-like events, for instance, a sequence could exist in a way that transcended a single appearance within the passage of time, by being repeated, reversed and so on. Yet this just seems to be a means of grouping or conceptualising phenomena with a single temporal dimension. So I am not sure. If anything is going to exert influence on these arrangements then it needs to operate in the domain of three-dimensional space. Beyond this perhaps a further level of influence seems conceivable where space-time itself is exposed to influences from without, creating “warps” or “wrinkles” in its passage. I am not convinced of this possibility either, but provided these don’t affect the passage of time uniformly, they might be detected as variations in the distribution of mass and energy throughout the Universe.

The relationship between cause and effect is central to a dynamic understanding of space and time. It is also important for an understanding of memory and the past, because so much of the knowledge we acquire and retain in this area is the result of reasoning from cause to effect, or vice versa. Knowledge of causes and effects is indispensable to the present too, where it guides our perceptions and actions and helps transform our surroundings into areas of concern and influence.

Traditional thinking on causal explanations looks to events as the source of causal influence. A cause and its effect are typically separate events with cause preceding effect, and the occurrence of the cause being deemed sufficient, under prevailing conditions, to bring about the occurrence of the effect. Thus striking the match causes it to ignite, provided it is dry and so on. Moreover, similar matches similarly struck under the same conditions will also ignite. Conceived solely in these terms, causality does not make up the shortfall of an understanding of the passage of time that materialist theories lack. References to preceding and succeeding events

presume rather than help explain its unhindered flow. Experience-based theories, on the other hand, are sometimes apprehensive about causes, and place consciousness beyond causal influence, and outside any spatio-temporal network. Some have found this exclusion helpful in defining the material world in opposition to a consciousness that eludes causal influence. All very well, but how the memory can supply knowledge of the past is a problem that remains unsolved.

A traditional account of causality has never been wholly satisfactory. Many causal explanations conform to the paradigm, but it is too narrow to encompass the full range in common circulation. Some causal influences such as gravity operate with immediate effect. Others like magnetism seem to reside in qualities belonging to objects rather than in events that precede their effects. Often referred to as dispositional, these qualities represent a wide variety of explanations that can be transferred or reversed. A glass might shatter when dropped because it is brittle, but the fact that it is brittle might be due to the fact that it shatters on being dropped. The location of a cause is very much influenced by the focus of interest in a sequence of events. Dispositions can cause events, and events dispositions. Dispositions can even cause other dispositions. We accept that damp conditions will cause some metals to rust, for instance, and examples of this type of explanation may refer to no specific events at all. Separate events do underpin the rusting process of course, but it is a single chemical reaction they represent. Causal influence is also something that can endure when the effects are suppressed, and can be a presence, as a field of influence, when no events at all appear to be occurring.

These varieties of causal influence by no means represent a decisive threat to causality as traditionally conceived, but they clearly present obstacles to a fuller understanding. More notoriously associated with this version of causality is the problem of induction. A knowledge of causal influence obtained through observation and repeated investigations is never enough, so sceptics maintain, to predict the similarity of all effects from the occurrence of similar causes. So, from discovering that some flames are hot, it is presumptuous to conclude that all flames are hot. The presumption is that there is a uniformity in nature when this has not been demonstrated. Such is the problem of induction. The uniformity may be a presumption that has worked well for us in the past but, so the sceptic continues, to believe that this is sufficient to establish the principal is to be guilty of circular reasoning. It presumes its validity in order to demonstrate it.

As Russell put it, even if experience has told us that past futures resembled past pasts, we cannot conclude that future futures will resemble future pasts. Best known of the dilemmas implied by the problem of induction is Hume's belief that we have "no reason" to suppose that the Sun will rise tomorrow. The Sun's unblemished record is not evidence, or adequate grounds, for predicting its punctual reappearance at dawn tomorrow. And the same holds true for the uniformity or persistence of the laws of physics that render predictable the Earth's orbit and every other event in the Universe.

The whole of inductive reasoning, by which we observe events in the past in order to form generalisations and make predictions about them in the future, has therefore been questioned. Not just causally related events, but any form of deduction based upon observed patterns and regular occurrences, is challenged by this sceptical line.

The challenge to inductive reasoning clearly cannot be taken seriously, since every moment of our waking lives places some credence upon it. Nor are the grounds for the challenge very convincing. The sceptical argument relies upon a division of reasoning into two types. Deductive reasoning is the sort by which conclusions are logically entailed by their premises and where any contrary conclusion is deemed inconceivable. So the fact that the Earth orbits the Sun is deductively entailed, for instance, by the facts that the Earth is a planet and that all planets orbit the Sun. No alternative conclusion can conceivably be drawn from these premises alone. Since it is theoretically conceivable that the Sun will not rise tomorrow, due to an unforeseen cosmic collision, for instance, it follows that the belief that it will do so cannot rest upon a deductive justification. So the sceptic argues as follows. This leaves only an inductive justification, and this is inadmissible because it is the principle of inductive reasoning that is being questioned. So inductive reasoning falls victim to its more incisive deductive rival.

Or so it seems. But does not the argument rebound upon deductive reasoning too? If we rule out deductive grounds for the belief in deductive reasoning because they presume the principle under scrutiny, then what hope is there for the validity of reasoning in any form, including that artfully employed by the sceptic? Demonstrating one type of reasoning does not demonstrably establish its validity. These senses of the word "demonstration" are quite distinct.

Even if the problem of induction cannot remain a lasting concern, its appearance does draw attention to a consequence of taking a traditional approach to causality. Characteristic of this approach is the isolation and linear ordering of events in time as a prelude to the search for causal links. The dynamic approach is quite different. It regards causal influence as fundamental and necessary for the location of events in time and space. The traditional view allows the possibility that all events might just occur with no causal interaction whatever, but the dynamic view insists that causal influence is necessary for the occurrence of any event. Every event is the product of the interaction of pulses of energy, transforming or superseding one another to assume pre-eminence in the present. Each represents a shift in the balance of the active or prevailing spatial and temporal boundaries.

So viewed, dynamism uses relations of cause to effect to explain the passage of time rather than leaving them unexplained within it. The past has become a redundant or obsolete network of forces. Its former pre-eminence is dynamically linked to a present that has superseded it through causal influence, and structured it in relations of cause and effect. This is possible because every event represents a transition between present and past and the conversion of the influential into the obsolete. The passage of time represents the sum total of a process that consigns all in its wake to redundancy. It is not a mysterious passage of time that converts present into past events, but the conversion process itself that records time's progress.

A dynamic perspective doesn't demand that we abandon our everyday understanding of causality. High winds will still lift tiles from roofs and sunshine supply the light and warmth that helps plants to grow. All it suggests is that we give more prominence to the view of the tile as suspended between forces keeping it in position, and forces inclining to dislodge it. From this point of view we can now more readily understand causal influence as a shift in the balance of a complex web of forces. Even the tile itself is the product of interaction of internally opposing forces exerted by the energy due to its molecular composition. From this point of view we are not limited to a single ideal type of causal explanation that the traditional theory favours. We can offer many admissible explanations for the dislodged tile. It may just have been a very windy night, and lots of tiles in the vicinity came loose. Due to its position perhaps, the loose tile may have been exposed, caught the wind and became dislodged. Weakened roof timbers may supply an explanation, and wet rot could have made part of the roof vulnerable. Poor workmanship, weak

cement filets or a strong up draught could also be to blame. All these are familiar and plausible causal explanations, but not all fit the traditional model neatly to produce clearly separated events ready for sequencing and labelling as cause or effect. If we impose too narrow a concept of causation upon the full range of explanations that are commonly on offer here, we obscure our understanding, not just of causal influence, but also of the passage of time itself.

Working within a dynamic theory causal influences operate to produce every event, so it is no longer possible to mount a decisive challenge to the validity of inductive reasoning. The sceptical argument will be unable to isolate events free from causal influence in order to be sceptical about possible causal links between them. The sceptical line of argument must presume the validity of inductive reasoning in order to query its validity. So it fails. Deductively! However viewed our inductive reasoning rests upon a pragmatic foundation. But pragmatism is deeply rooted in a dynamic philosophy, because a pragmatic interest shapes and defines every discovery that reality reveals to us. In discovering inductive truths we are finding out about reality itself and become more effective instruments of our objectives there. The validity of the grounds for successful and true beliefs will persist until challenged and superseded by better ones. Unless and until we have evidence to suppose that the Sun will not rise again tomorrow, we shall continue to concern ourselves with more important matters.

Relationships of cause to effect are important in a dynamic theory because the pattern of history is produced by chains of causal influence, with one source of influence superseding another and in turn losing its pre-eminence. Defining the past is a redundant or obsolete network of influences, linked to the present by these causal chains. The loose roof tile has become a part of the past because the forces retaining it have been overcome by the winds that dislodged it. The loss of one tile may have exposed a second which was also dislodged. Both now a part of the past, the loss of the first precedes the second because it produced a shift in the balance of forces operating on the second and so contributed to its removal. The loss of the first was necessary for the loss of the second to occur, and so preceded it. Accordingly, locating events in time requires us to trace these chains of influence.

When we look at the richness of some of our perceptions, it has been tempting for many to suppose that the past, with all the associations and memories it brings to bear upon the quality of perceptual

experience, is somehow woven into the present. Tempting but erroneous. All experiences occur entirely in the present, even if past events, or knowledge of them, contribute to their unique character. If we treat past and present as an amalgam primarily located in experience, it becomes impossible to separate them and arrive at any understanding of an independent past that once comprised reality. Indeed the problem of access to a reality at any time for experience-based theories remains omni-present. The past does exist in the present, but only to the extent that evidence for its existence is everywhere apparent in the composition of the present.

Our perceptions of reality are significantly influenced by the knowledge we acquire and retain from the past. The sight of a cube with its unseen sides is a much-examined example of how the mind extrapolates from what is strictly visible to the eye to the recognition of a fully constituted shape. It is a good example to consider, but the model of perception it has promoted is misleading. It suggests that the perception is encapsulated into the fixed viewpoint of an instant, with the eye opening as a shutter to receive the data that the brain will process with the aid of the memory. It belongs to the era of the pinhole camera. A dynamic alternative has been suggested in earlier chapters. The perception is much more of an investigative process involving the eye and brain in harness, the knowledge we have acquired and retained informing the directions both will take. The direction of our interest is critical here, because the concepts we apply to any object will influence what we discover about it, and these are concepts we have acquired and developed in the past. Heightened powers of discrimination reveal a lot more about an object, and much about ourselves too. Our background, education and experience all influence what we are able to discern in our surroundings. Our knowledge of a cube starts out as an enquiry that engages the cube in a process of continuous investigation. The detached perception of later years is a shortened version of early investigations that considers only small visual aspects of the cube, such as the shadows it casts. It is not necessary to subject the cube to a full investigation, because the memory can inform us of its likely direction and results.

It is not possible to discuss time and the past for very long without introducing the faculty of the memory. In experience-based theories the discussion cannot escape the topic, because establishing the existence of any past independent of the memory remains problematic. It is a problem that runs parallel to the problem of perception. If our only access to the past depends ultimately upon

memory experiences, how can the validity of memory-based claims in general and the reality of the past be ascertained? Distinguishing memories from other experiences is also a problem, since they don't seem to have any special memory quality attaching to them. Even the clearest and most enduring experiences of the past don't count as memories unless we recognise them and can correctly locate them there. The feeling of conviction that accompanies a vivid experience, such as where I was when I last put down my screwdriver, is no recollection if it is mistaken. Nor does it seem necessary to have any special memory experiences for the memory to operate. Remembering my own name brings to mind no particular thought or experience, for instance.

Problems such as these should not trouble a dynamic theory of memory. The past exists independently of our capacity to remember it, through the operation of causal influence. The memory represents our capacity to know the past and can assume several forms. The ability to place events in the past and to select events from it represents one form. This involves locating and ordering events there. Another form is the capacity for imaginary experiences, and an ability correctly to attribute them to actual past incidents. Memory experiences represent a creative departure from reality in its present state, but retain a contact with the past. We know that what we experience is a redundant scenario, and can recognise its causal relationship with the present state of reality. The faculty for learning is memory in a third form, and one where we are able to retain knowledge and aptitudes acquired in the past. Whereas the first two forms refer to our ability to locate events in the past, the third principally records the influence of the past upon ourselves. Labelling such changes as exercises of memory is justified because a reference is implied to a past, and to points within it, when the retained knowledge or skill was acquired. Highlighting the difference between these forms is the fact that it is not necessary that we remember how or when we acquired the knowledge we retain. Usually the ability to demonstrate such skills or knowledge is convincing enough as evidence that we possess them. The ability to use language is an example. Much of what we learn is best understood as a skill, retained for use when required. Some factual knowledge may be presented as an exercise of memory in two or more forms, depending upon the point that is being made, but I don't think this threatens an analysis of memory into types.

If we look to the future from a dynamic point of view we can understand it as the direction taken by the impetus of the present.

Not yet realised and so not an estimable force, links from the present to the future may be traced in causal connections and, at a human level, assisted by our knowledge of those who are in a position to influence and exploit them. In an astronomical realm beyond human influence, events such as eclipses may be predicted with certainty. In contrast an arena dominated by human interaction is bound to generate uncertainty, because people are complex and can always be found to confound the predictions we make for them. I will discuss more fully the crucial issue of human freedom more fully in a later chapter.

Having proposed a real and objective passage of time, it becomes necessary to explain how we can measure it independently of our first hand experience of its passing. I have suggested that the recognition of causal links is a requirement to begin comprehending time's passing, and to locate events as predecessors and successors to one another. This falls some way short of explaining how we can measure the duration of events or the length of time between them, and how we arrive at the idea that all events take place within a single integrated passage of time, where simultaneity is possible. With time the fundamental dimension encapsulating all things, it would seem to be impossible to get outside and get its measure.

Fortunately the measurement of time with a timepiece need not be a problematic exercise. Single units of time can be devised and recorded with any instrument that performs at a steady rate. Hourglasses and candles have been commonly used to record time in this manner. However it is not possible to test the reliability of these or develop a standard or divisible unit of time without being able to compare different instruments. One way to measure time thus is to choose an object as likely to produce a regular pulse, such as a pendulum. The next step is to replicate it with another so that the regularity of both can be tested. The test isn't just a matter of swinging the two simultaneously to see if the frequency of the swings coincides, since both may slow at a uniform rate. It will also be necessary to swing one and delay the start of the other, to check if the cycles still coincide. Swapping positions, or changing locations and conditions, provide further checks, and adjustments can be made until both pendulums have the same swing cycle under all conditions. If simple pendulums don't possess the required range and accuracy, then some other mechanism needs to be sought. But the end result should be a crude measure of time suited to all the conditions under which it has been tested and found adequate.

The measurement of time is straightforward for a dynamic theory because we do not seek an absolute passage of time in the sense that it exists independently of the occurrence of events within it. We are not looking for an instrument that has to conform to some absolute standard. Time does not flow in any literal sense, for to suppose that it does is to locate it in time. Time is the measure of everything in the Universe, and supplies ample means of devising a standard for the location and duration of events.

So dynamism furnishes us with a definition of time and supplies the means of measuring it too. All in one simple sentence. Time is the measure of the dynamic process. It does not exist independently of events, as an empty passage along which events are drawn. Nor do events exist independently of a time that can be distilled from relationships between them. The advance of time and the course of events are inextricably bound up with each other, so any attempt at separation will only cause confusion. Time's passage is central to any definition of events, and is defined by their occurrence in turn. Time is of their essence.

If this dynamic definition of time is also confusing, then a more homespun simile may help. Time and its measurement have features in common with money and evaluation. When commodities are exchanged in the market place, it is possible to represent their relative or changing values in terms of units of currency. Money represents a means in terms of which the value of all commodities in a market can be expressed, and its value is its purchasing power there. Money replaces barter in diverse markets as a useful single means for evaluating all commodities. Market value is determined by the relationship between commodities, and the relative rates at which they are exchanged. Value is real and objective, and a currency represents an independent means of expressing this. Money is an independent measure of value, and yet has no value independently of the market place. Just the same is true for time as a measure of events. The duration or frequency of events can be located in the relationships they form through the influence they exert on each other, and time is an independent means of representing these.

So dynamism rejects the notion that Time marches to a constant and relentless tempo that is independent of the passage of events. Primitive efforts at measuring time produced unreliable timepieces recording wide discrepancies in measurements, and might have appeared to support the view that Time flows at a fluctuating rate. The discrepancies were of course attributable to the unreliability of

materials and workmanship in the early clocks, where differences in temperature, humidity or other conditions influenced their readings. Unreliable clocks have a limited use, as do blunt tools, but their movements have to be compensated for. Producing accurate clocks that perform reliably under all conditions has represented a formidable challenge to men of great ingenuity for several centuries. But since Einstein's discovery of the relativity of time, it appears once again that the passage of time itself varies its rate of flow and will produce discrepancies in the most accurate of clocks.

Einstein's special theory of relativity was developed as a response to the discoveries of scientists working in the late nineteenth century, who found that measurements of the speed of light always produced the same result, irrespective of the speed at which the instruments of measurement were travelling. It didn't matter whether they measured light travelling towards the Earth or away from it. The results were always the same. Within the Newtonian scheme, this generates a paradox, because the true speed of an object must always take account of the speed and direction at which the instrument of measurement is travelling.

Einstein's resolution of this paradox is the proposal that the passage of time itself varies its rate of flow in proportion to the speed of the clock nominated to measure it. The velocity of the clock, expressed as a proportion of the speed of light, will be matched and offset precisely by a change in the rate at which the instrument measures time. A constant measurement of the speed of light will always result from accurate measurement. Moving towards a light source, a clock will measure time at a faster rate, and moving away, at a slower rate.

A central part of this radical proposal is the idea that the mass of a body and its energy are inversely proportionate, and that both increase exponentially as the speed of the body accelerates towards the speed of light. Doubling a clock's speed for instance quadruples the product of its mass and energy, requiring much more energy to ensure that it continues to measure at a constant rate. These effects are scarcely discernible at low speeds, but clocks accelerated into orbit around the earth measure time at a slower rate. Light enjoys a special position in the post-Einstein universe, because its velocity is a constant. Light has virtually no mass, and consequently travels faster than anything else. Anything possessing mass would need an infinite amount of energy to reach this same speed.

Einstein's theory embodies a reappraisal of matter where mass is no longer an absolute and fundamental property, but is now conceived as a variable that is influenced by energy or velocity. Since any measurement of time is dependent upon these variables, it seems to follow that there are no fixed points in an absolute passage of time, but only measurements of time that are relative to the mass and velocity of the means of measurement. The relativity of time appears to support a concept-relative understanding of time, space and the reality that appears within its confines. According to this view everything that can exist in time and space is only conceivable if it can be observed and measured. The existence of things becomes dependent upon the conceptual framework we devise and apply to reality. No absolute time or space exists beyond our ability to determine its extent and duration of what it contains. Such is the concept-dependent view.

Einstein's special theory uses mathematics to draw conclusions that are scientific in nature, and has generated predictions that have been verified through experiment and investigation. It also supports a dynamic understanding of reality, with its conception of mass and energy as complementary aspects of matter. However the relativity of time has been taken as confirmation for a concept-based philosophy, albeit with a dynamic impetus. I am not sure this is justified. Support for the concept-based position is found in the rejection of an absolute time flowing at a uniform rate. Time can only be a product of what an observer measures its rate of flow to be, so concept-based theories conclude that Time is an observer-dependent feature of the Universe.

Concept-based theories appear once more to lead to relativism. Indeed they confuse relativity and relativism. If both time and space are observer relative then each of us occupies our own reality with its own time and its own space. No longer can our observations converge upon a common reality where truths can be located and shared. Each of us becomes locked into a personal perspective that necessarily cannot encompass any other.

Fortunately the acceptance of the Special Theory does not commit us to a concept-based understanding of time and reality. I have described a simple way in which we can devise a means of measuring time objectively and accurately, and which can be tested under a range of conditions. The relativity of time represents the discovery of a new condition that will influence the measurement of time. The speed of the clock will influence the readings we obtain.

Just as the temperature, or the surrounding air pressure, or the stability of the clock did for the pioneer clockmakers. No doubt it is possible to locate conditions under which the results of any sort of measurement will fluctuate, but these are insufficient grounds for drawing the conclusion that all forms of measurement are subjective. The nature and extent of such influence, for instance, can only be located where it is conceded that some form of measurement has an admissible accuracy. Conditions that produced fluctuations represented challenges to the clockmakers that they progressively overcame. The relativity of time represents a new challenge that is, admittedly, probably insuperable. To overcome it, the task will be to construct a clock with no mass, and consisting entirely of light pulses. Such a clock would measure time at a constant rate under variations in all known conditions. Without such a clock, however, we can continue with the best atomic clocks we have, in the knowledge that we are able accurately to compensate our settings, calculations and measurements wherever necessary. The special theory does not prove that there are different times flowing at different rates, but only that different conditions will influence the measurement of time.

If time is the measure of the dynamic process, then Einstein's theory is very important for locating new and significant conditions for a dynamic philosophy. But only to one who is predisposed to a concept-based view of time will it seem to follow that there is no independent and objective measure of time. Events may no longer have a fixed position in time, but they can still be accurately located there. Concept-based theories take too literally the idea of time flowing at different rates. Indeed it is confusing to think there is great import in the idea of time flowing at all. Concept-based theories confuse the flow of time with our measurement of it, when it is the different rates at which clocks measure time that should be the primary concern.

Einstein's discovery of the relativity of time builds upon Newton's laws that implied the relativity of space. Prior to Newton, the traditional view had been that space comprised a fixed framework of equidistant points in space, specifying uniquely the position of any object located there at any point in time. Newton's Laws challenge the assumption of inertia that underpins the traditional view. They represent an attempt to redefine space in the light of astronomical discoveries that were revealing the Earth and everything observable from it to be in a state of constant movement. Together his Laws replace the Space of the Ancients with a dynamic universe, whereby an object in motion is assumed to have constant velocity until acted upon by some force.

Nothing is needed to keep an object moving once it has been set in motion. With no fixed points in space against which to gauge motion, all that we can measure in space are the distances between objects and plot the relative changes over time. With just two objects, for instance, it is not possible to determine whether one is stationary and the other in motion, or the other way about. Not until some third object is nominated can the motion of each be measured against it. On the Newtonian view, inertia becomes conceivable as a constant measure of distance obtained from objects moving in parallel. No longer are there fixed points or directions in space such as up or down. Only directions that accord with or oppose the gravitational pull of the Earth or some other body.

A Newtonian view of space does not suggest that there is no such thing as spatial position, but only that spatial position is fixed by the positions of objects in relation to each other. Measurements of length and direction may be relative to the position of instruments of measurement, but the measurements are real and objective nonetheless. Under Newton's Laws a new range of conditions have been located which influence the results we obtain.

Einstein's General Theory is concerned with gravity and builds on Newton's conception of the relativity of space to undermine the idea of absolute matter. On the Newtonian model gravity is a force that acts on matter in proportion to its mass, instantaneously and extending over enormous distances. Newtonian bodies possess mass, energy and exert gravitational pull. Because nothing can travel faster than the speed of light, and gravity works instantaneously, Einstein rejected the view that gravity is a force in its own right that acts upon matter. Rather gravity, or gravitational pull is a defining feature of matter itself, and a way of representing the distribution of mass and energy in the Universe.

The General Theory implied a new and dynamic conception of matter, now defined in terms of its power to promote or resist changes in the positioning of other objects. Matter represents the power to influence spatial relationships. No longer a stable structure for the energy it exerts, matter is now identified with that energy. In consequence, objects are no longer conceived as changing their positions within an absolute space. Rather the scope for such change actually defines space itself. Another consequence of the General Theory is that space is not an unbounded domain, infinitely extended in all directions, but is bounded by the sum total and distribution of the matter it contains, exerting a pull that will always tend to draw back

towards its centre any body that strives to escape its influence. So nothing can be placed beyond the positioning power of space. Such a zone cannot be conceived as any sort of area of space at all.

Similarly, according to Einstein, time does not extend infinitely into both past and future. The rate at which time can be measured is in relation to the mass and density of the Universe, so if we can conceive its mass concentrated to the point where its density is infinite, then the passage of time will effectively have ground to a halt. There is much evidence to support a "Big Bang" theory of the origin of the Universe providing just these conditions. The suggestion that the Universe will cease to expand one day and begin contracting towards a "Big Crunch" also has its adherents. Both these critical events offer starting and finishing points for the passage of time itself, disposing of the infinitely extended timeline of history that many find difficult to comprehend or accept.

Einstein's theories are testable and supply us with calculations that supply predictions that enable us to verify the effects of measuring phenomena under a new range of conditions. The application of Newton's theories would anticipate identical results under these conditions, but Einstein discovered a new scope for variation in the measurement of space and time. The resulting theories sit quite happily with a philosophical dynamism, not least because they have helped to shape its development. But I am concerned at some of the other philosophical interpretations that have been placed upon them. In particular I am unhappy with two suggestions: one, that only what is conceivable and can be measured is at all possible, and two, that there are no absolute measures of time and space, and so no absolute reality. The only reality is relative to an observer and the means of measurement at his disposal. Such is the interpretation that concept-bases theories place upon the relativity of time and space. It is misguided because Einstein's theories do no more than locate new conditions for the observation of phenomena in time and space. The supposition that this is an ample demonstration of an observer-relative time and space only creates unnecessary confusion and difficulties.

One difficulty posed by a relativist time and space is that it stands in the way of scientific investigation. Without an absolute measure of time, for instance, it becomes impossible to measure the date of Big Bang. Whatever units of time we use to count back to Big Bang, the last unit must be of infinite length, reflecting the concentration of matter at that point, and implying that the event took place an

infinitely long time ago. This hardly accords with an understanding of time that is finite and inaugurated by Big Bang. Similarly the boundary of Space must be an infinitely extended distance away because, whatever unit of distance is used, the last unit must become infinitely extended or stretched, due to the infinite amount of energy required to extend that far.

Yet cosmologists seem to have no difficulty estimating the age of the Universe from its inception at Big Bang. To do this they extrapolate back from a measure of Earth time. But is this covert use of Earth time to give an absolute measurement of time admissible? If we are permitted to measure back towards Big Bang in Earth time, then why not beyond to an earlier era? A concept based understanding of the relativity of space and time produces a paradox. It does away with the idea of time and space measured in as infinitely extended sequences of finite units, and replaces them with finitely extended sequences of infinitely extendable units. Both methods also lead to the conclusion that time and space are both infinitely extended. Hardly what Einstein had in mind. Of the two methods, clearly an absolute system of measurement would be preferable. The whole point of using any system of measurement is to enable comparisons to be made by standardising the unit of measurement. A standard measure of length or duration makes a direct comparison of results possible, and no appeal to another system of measurement is necessary. An absolute standard will produce consistent sets of results, in spite of differences that may be due to conditions of measurement. Condition-relative discrepancies when they arise can also be detected and measured using that same absolute standard. The idea that a unit of time expands in proportion to its proximity to Big Bang requires just such an absolute standard. Relativity is a valuable concept, but should not be interpreted too literally. It relies upon and so cannot replace some absolute standards of measurement.

Another objection to a relativist interpretation of relativity is that it flies in the face of good scientific practice. If the Big Bang hypothesis is scientific, then it must be falsifiable or open to test. It may be, for instance, that the Universe is far vaster than we calculate it to be, and that Big Bang, if it occurred at all, was in cosmic terms a parochial occurrence with little impact upon the rest of the Universe. On the relativist interpretation Big Bang represents an impenetrable barrier that heralded the beginning of Time. But this is to attribute too much in the way of ontological significance to a scientific hypothesis. Should we ever discover remote bodies whose motion, if any, is

unaffected by Big Bang projections, then a radical reinterpretation of time, space and the Universe will be called for, and the idea of an infinitely extended time may well be reinstated. Good philosophy should be able to anticipate and accommodate such contingencies and not make the boundaries of present scientific knowledge its own. It should continue to resist any tendency to turn the existing state of knowledge into a dogma.

In any event a dynamic representation of time and space permits a more plausible account of their limits. There is no need to regard space as an empty vessel that contains the material universe. A dynamic conception of space defines it as the scope to influence the relationships between objects, in separating or combining them for instance. Science predicts that the available room for manoeuvre diminishes towards the edge of the Universe. If correct then the predictions represent limits or boundaries to Space without suggesting that something must lie beyond them. Similarly time is defined as the scope for events to occur. Science tells us that the scope for manoeuvre diminishes in proportion to the concentration of matter and that the mass of the Universe was concentrated into an infinitesimally small space at the point of Big Bang. Again, if true, this represents a boundary to Time without committing us to the supposition that something must have preceded Big Bang. It is tempting to persist with the ideas of Time and Space as empty and infinitely extended, but this is to give them a static existence independent of the history of the Universe. Dynamism restores their place within the course of events, but is also able to validate their objectivity and measurement.

We are all familiar with the different time zones into which the World is divided. Adopting them allows us to relate daily routines more closely to the progress of a solar day, and is found useful by those communicating or travelling between zones. In a sense each zone represents a different "time", but all the zones run in parallel, and translating one zone's time into another is not a source of chronic confusion. Manned space stations present a new challenge because they travel at considerable speeds and record a slower rate of time flow than back on Earth. Long-term occupants of the station may find it more convenient to create their own time zone. The calculations for converting one time to another will be more complex, but the principle is the same. We would all be living simultaneously, but under different conditions that influence our measurement of time. It doesn't take too much imagination to suppose that easy space station travel will spawn a new breed of "anoraks" making travel arrangements to

maximise holiday entitlements and savings interest. It is misleading to say however that time itself is flowing more slowly on the space station. Both Earth time and Space Station time stand at an equal distance in time from all other events in the history of the Universe, starting with Big Bang, through to the formation of the Crab nebula, the building of the pyramids and to the present day. Different measurements in different times can be converted to a single standard unit. Deciding which one to adopt is not an arbitrary choice, as relativists would suppose. Why not the most stable, reliable convenient and accessible? All very good reasons for choosing one unit over another. If this sounds too facile then recall the analogy of time with the market place. Converting times in different and diverging zones is like working with different currencies with fluctuating exchange rates. Time and money are perhaps more closely associated than has been intimated!

The present chapter has been largely given over to the consideration of time with the aim of freeing the concept from some of the paradoxes associated with it. Dynamism can offer us an accessible definition of time, can explain its passage and direction in assimilable terms. There is no need for theories of time and space to be incomprehensible to the general reader, since we all know what both are. When I first studied philosophy I believed that wisdom could be found in esoteric new systems of transcendent truths, discovered and perfected by philosophers. Now I am arguing for a wisdom that emerges from a closer understanding of the dynamics of our everyday conduct and experience. The challenge for philosophy, I contend, is to articulate that understanding clearly and concisely.

A dynamic theory of time is adaptable and doesn't impose limits upon its beginning and ending. It gives us a passage of time that is as old or as long as history requires it to be. Nonetheless it is the only Time there is and so monopolises the historical process. Time's progress is unique and absolute, and the different or fluctuating time bubbles that appear within its flow are the product of changing conditions under which time is measured. Only against the background of Time's progress do they appear at all. Time warps and multi-dimensional universes can make Time sound like a much more complex phenomenon, but it doesn't have to be so. So what should I say next time a three year old asks, "What is time?" This is still a difficult question. I haven't tried it yet, but I might venture, "Time is how we measure things that happen. How long they take to happen, and how often they happen." Then lots of examples. Any more suggestions?

Summary of Conclusions. Time is more fundamental than space in a dynamic universe. Time features in all dynamic encounters and temporal boundaries form where these produce events. Time and change are not inseparable as only one type of change is pertinent to our understanding of time. To some extent recognition of change will depend upon the concepts we deploy to characterise reality.

A traditional understanding of causality hinders our understanding of Time and gives rise unnecessarily to the problem of induction. Dynamism makes a radical break from the traditional view with the proposal that causal influence is fundamental and necessary for positioning events in time. Causality does not emerge from between encounters or events. It is causal influence that produces them. Relations of cause to effect explain the passage of time rather than leaving events stranded and unexplained within it. The problem of induction relied upon such events to give it expression, and accordingly disappears.

The present is simply represented by the sum total of the active energy or the potent forces that are in operation. The past is a redundant or obsolete network of forces. Its former pre-eminence is linked to a present that has superseded it through causal influence. Every event represents a transition between present and past and the conversion of the influential into the obsolete. We can understand the future as the direction taken by the impetus or influence of the present.

Time is the measure of the dynamic process and consequently of everything in the Universe. It supplies the means of devising a standard or measure for the location and duration of events.

Space is the arena for a subordinate set of relationships within time, and represents an axis that cuts across the passage of time. Space is not a separate realm, but represents Time persisting under conditions where positional or displacing influences come into operation. Both space and our apprehension of it are fundamentally three-dimensional.

Time and Space are real and objective. Causal influence ensures that past, present and future exist independently of our capacity to remember, witness or predict them. Although it is the measure of a dynamic universe, Time itself can still be measured. The relativity of time is best understood as resulting from conditions that influence its measurement. There is a danger of misconstruing the relativity of time and space in terms of a relativism that depends upon subjective observer viewpoints. There is also a habitual belief in regarding their existence as limitless beyond their scope to produce events or manoeuvre objects. Dynamism avoids the confusions that both produce, and offers us an understanding of both time and space that is measurable, but which does not abstract them from the passage of events and the existence of objects.

