An Attitude to Time*

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1 Introduction

Time is a very puzzling phenomenon of which there is no generally accepted understanding. However we all have to have an attitude to time, and a great deal of unhappiness is caused by people having a negative attitude to it, which may completely warp their approach to life. I therefore seek to develop an attitude to time that is at least reasonable and acceptable to me and, hopefully, to others. To do this one must look at the various ways in which time presents itself to us, both in scientific theories and otherwise. These are in some respects incompatible, so one must take careful account of all of them in order to reach an attitude that is reasonably acceptable. As I am only seeking an acceptable attitude rather than a definitive philosophical conclusion it seems inappropriate to lumber the article with copious references to the extensive literature.

2 Ordinary Common-sense Time

Always jam today; never jam yesterday or jam tomorrow

Before one starts theorising about time and its nature and how it affects our lives it is essential to be clear about how we experience it. If what we say about it does not really tie up with our experience it will not help us to deal with our problems.

It is commonly said that we experience time as a kind of flow; "time like an ever flowing stream bears all its sons away". But although that is what it seems like in some circumstances, it is not really true. If you watch the sun shining through a window on to a wall at right angles to the window then the edge of the shadow moves quite rapidly, and you can actually "see it moving"; but I do not think that this is really the best way in which to describe our experience of time. The sun's shadow *moves;* and

*This seems to be the article mentioned in "Religious Development" as having been written in 1996, rather than the earlier attempt at a book on the subject. *[RW]* what we experience is a sense of the *speed* of its movement; but speed is measured in terms of the distance travelled in a certain time. Thus our experience of the movement depends on our experience of the passage of time, but has to be distinguished from it. The idea that we experience time as a flow leads us into all sorts of confusion. We say that when we are bored time goes slowly, and when we are busy it races along very fast, but this does not really make sense because speed is a rate of change of something with respect to time. Time could only flow if the speed of its passage could be considered relative to some other sort of time, and then that would have to flow relative to some third sort of time, and so on. Such ideas have been propounded by J W Dunne (in *An Experiment with Time* and *The Serial Universe*), but they are very cumbersome and we have no direct reason to suppose that such an infinite series of times exists.

Our experience of time is really much more like that portrayed by a digital clock, which instead of having a moving hand displays a succession of present moments. Nowadays such clocks usually present a series of illuminated digits which change up every minute or every second to tell us the actual time, and of course we do not experience time in a precise numerical way like that. The first digital clocks, however, worked by turning over a series of flaps on which the numerals were written. A clock like that with blank flaps is rather like our direct experience of time; a flap corresponding to a “present moment” keeps flicking over in our consciousness – perhaps about ten of them every second, since that is about the smallest time interval that we can resolve in noticing changes in our environment.

The next thing that we have to take into account is our distinction between past and future. The only point of time that we actually experience is the present moment, but we remember a long series of such moments that we call the past, and we expect there to be a further long series of such moments that we have not experienced “yet”. We expect these “future” moments to exist whether we look forward to them in hope or with dread, or even if we do not expect to be conscious (or even alive) to experience them. But we never actually experience either the past or the future, only the present. That is why the usual form of the saying about jam today and jam tomorrow is so frustrating; it appears to mean that we never enjoy any jam. In fact the only time that we actually enjoy jam is today, whether it is today’s jam, or the memory of yesterday’s jam, or the anticipation of tomorrow’s jam!

An important feature of our experience of “the present moment” is that it is the point at which we exercise our faculty of freewill. We make decisions about what we will do, and these decisions affect the future and not the past

We cannot count the moments of our subjective experience of time, and therefore in order to quantify it we identify various cyclic operations and count those. The most obvious one is of course the cycle of day and night. It is long enough for us to count it fairly easily, either in our memories or with the help of notches in a stick like Robinson Crusoe. In order to deal conveniently with longer periods we move to the almost equally obvious cycle of the phases of the moon, and then to the rather more sophisticated observations required to appreciate that the sun moves through a yearly cycle. That is long enough for most practical purposes, and the longest cycle that we can appreciate during our individual lives.

For people to measure shorter time intervals than a day used to be much more difficult because of the lack of obvious shorter regular cycles. This problem was solved by the discovery of the seconds pendulum. A pendulum clock is just a device for counting the cycles of oscillation of the pendulum, and modern clocks are similarly devices for counting the vibrational oscillations of a quartz crystal or caesium atoms.

3 Time in Literature

In spite of the fact the we normally seem to be firmly anchored to the present moment, there is one way in which we seem to be able to free ourselves from this tyranny of the present. When we immerse ourselves in a story we are able to identify ourselves with the time in which the characters operate, we share their memories of their past and we feel their anxieties and hopes for their future. Of course we actually do this in our present, but while doing it we cease to be aware of that, and the internal timescale of the story takes us over. If the story is a work of fiction there is a remarkable degree of freedom in the relationship between the story's timescale and ours. The story may be set in a defined time in our past life, in which case we may well contemplate what we were doing at the time concerned, or it may be left completely undefined in relation to our time and this does not worry us at all as we read it.

An author can invent a timescale, and indeed start telling the story at any point within that timescale, about characters who are endowed with memories of earlier events of which we are not cognisant. This has been considered by Dorothy Sayers in her book *The Mind of the Maker.* It is related to the emphasis we normally give to the notion of priority of an event in time over the notion of its priority in terms of its significance, and these notions may be inverted by an author. In real life nowadays we tend to consider only effective causes and to dismiss the meaningfulness of "final causes"; that is the idea that some things happen in order that subsequent things may happen. To arrange this in a story is obviously an essential part of the skill of the novelist.

4 Newton's Time

We must now move on to consider various aspects of time in scientific theories, and how they impinge on our ordinary common-sense, subjective, approach. The first theory to deal with is that of Newtonian mechanics, because it was historically the first and is the simplest and the least controversial.

Newtonian mechanics deals with the velocities and accelerations of objects under the influence of impressed forces. The position of an object is described in terms of its location in the three dimensions of space (which we typically describe as length, breadth and height). Given its position at some instant, a Newtonian analysis of the forces acting on it will give its location at all subsequent times, and also at all previous times. Time is a parameter in terms of which positions in the three spatial dimensions can be calculated.

This appears to be very much in line with our common-sense approach to time, which is very tied up with the observing things moving about, but it differs in two important respects. It omits our idea of the present instant, and it has very little to do with ideas of past and future because it is indifferent as to whether time runs forwards or backwards. In Newtonian time the situation of the world at successive instants is rather like that portrayed on successive frames of a cine film, and the whole history of the universe is contained on the film. To a person watching the film there is, at any moment of his subjective time, a past that he has already seen and a future that he has not yet seen, but objectively these both exist on the reel of film itself. The future therefore seems to be foreordained and as immutable as the past. Moreover the things with which Newtonian mechanics deals make equally good sense whether the film is run forwards or backwards. A film of a model of the solar system with the planets going round the sun would make equally good sense forwards or backwards; reversal of time simply interchanges clockwise and anticlockwise motions.

5 Einstein's Time

Einstein's Theory of Relativity deals with the same kind of phenomena as Newtonian mechanics, but there are important differences between them.

This is usually described by saying that according to Einstein time is the fourth dimension, but this is somewhat misleading. Even in Newtonian mechanics there is a sense in which this is true. If one considers an object moving along a line, one can plot its position as a function of time on a two dimensional graph with time plotted along the second dimension. Application of Newton's laws then corresponds to an analysis of the geometry of this two-dimensional graph. Similarly their application in the three dimensions of space corresponds to an analysis of a four-dimensional graph in the three dimensions of space and one of time. However this ignores the fact that there is no inherent relationship between the scales of the graphs along the space axes and the time axis. There is therefore no clear meaning to be attached to the concept of a *distance* between two points on such a graph. According to the Theory of Relativity there is a precisely defined and necessary scale for the time axis: the time must be multiplied by the velocity of light before it is plotted. So if the space dimensions are measured in metres (say), and time is measured in seconds, then the time axis must be plotted in *seconds times the velocity of light in metres per second,* i.e. in metres just like the space axes, and so a distance between two points on the graph is to be measured in metres.

There is a however a further complication. The essential principal of the Theory is that all observers observe light to pass them at the same velocity (c regardless of their own relative velocities, and for this to be true it is necessary that measurements by different observers of distances and time intervals between events should depend on their own relative velocities. That is, my velocity (relative to someone else) changes a component of what he sees as a space-like distance into a component of what I see as a time-like interval, and vice-versa. In other words time is not a specific one of the four dimensions of space-time, but differs in its orientation for different observers with different relative velocities.

A simple analogy is to consider two surveyors measuring the distance between two objects on the ground. A normal procedure would be to measure the components of their separation in the north-south dimension (y) and in the east-west dimension (x), and these values would be absolute ones on which they would agree. However, it would also be possible for the surveyors to make their measurements parallel to the direction in which they happened to be facing (*f* for forwards) and at right angles to this (*s* for sideways). If surveyor A finds these components to be f_A and s_A whereas surveyor B finds them to be f_B and s_B then they will both obtain the same distance between the objects because

$$f_A^2 + s_a^2 = f_B^2 + s_B^2$$

However the ratios $\frac{f_A}{s_A}$ and $\frac{f_B}{s_B}$ will obviously be different if the two surveyors are not facing in the same direction.

The corresponding situation in relativity is that if two observers A and B, moving relatively to one another, observe two events and measure the spatial distance (x) between them in the direction of their relative velocity and the interval 1 between them in time, they will disagree with one another as to the values of these two quantities. From their observations x_A, t_A and x_B, t_B they will obtain the same space-time separation of the two events, but the difference between the values of $\frac{x_A}{ct_A}$ and $\frac{x_B}{ct_B}$ will be related to the relative velocity of A and B in an entirely analogous way to the relationship of $\frac{f_A}{s_A}$ and $\frac{f_B}{s_B}$ to the angle between the directions in which the two surveyors were facing.

Thus time is not a specific dimension like east-west, it is more like "sideways", and depends on the direction in space-time in which I am "facing" as a result of my relative velocity; this controls the direction that I experience *sequentially* as time instead of as space.

Apart from this Einstein's time resembles Newton's time in knowing nothing of a present moment, and in being reversible so that calculations forwards and backwards in time are indistinguishable.

6 Thermodynamic Time

Although according to Newton or Einstein the history of the universe is like a cine film that can be run either forwards or backwards, in real life one cannot unstir a cup of tea and take out a spoonful of sugar, and a dropped and broken glass does not reassemble itself and jump up on to the table. It is curious that it took scientists so long to realise this was a deficiency, since even in the seventeenth century it must have been well known that apples do not jump up off physicists' heads and attach themselves to the branches of trees.

The irreversibility of time is enshrined in the Second Law of Thermodynamics, which states that spontaneous changes in an isolated system always involve an increase in the degree of disorder in the system. A cup of tea with sugar dissolved in it is more disordered than a cup of unsweetened tea with the sugar still in the teaspoon, and a fragmented glass is more disordered than an entire glass near the edge of the table. We are so used to these facts that it is surprising how difficult it is to give an adequate account of why the more disordered situation always occurs after the less disordered situation and not before it.

The usual explanation is that spontaneous processes correspond to increasing disorder simply because a more disordered state at the later time is much more probable, but this explanation is probably too facile. It assumes that the present situation is always a rather improbable one, so that a system can always move to a less improbable one. But why should the present situation be in such an improbable state, and how did it get like that? After all, the most probable state for it to have been in the past would also have been one of greater disorder.

In some cases the answer to this is clear. Neither the glass standing on the edge of a table nor the teaspoonful of sugar about to be stirred into the tea is a natural situation. The one is an artifact of the glassblower's skill and the other of the sugar refiner's. But it would seem that there is a difference when we consider the apple falling on the head of Sir Isaac Newton. Apples do not jump off physicists' heads and attach themselves to branches of trees because the fall of the apple is the first step in its progressive decay, and the decay of a perfect apple to a nasty mush is an obvious example of an increase of entropy. The perfect apple was therefore in a low entropy state that arose naturally, and one is faced with the problem of how this came about.

The growth of an apple could well be the subject of a slow time-lapse cine film. The underlying facts behind it would be the extraction of the carbon atoms from the carbon dioxide in about a thousand cubic metres of air and their arrangement in very precise molecular patterns within the small volume of the apple – a very remarkable example of an enormous decrease in entropy. If the film were shown in reverse we would see the gradual shrinkage of the apple as its contents were dispersed into the atmosphere, and although we know that this is not what happens it would not look at all unnatural. Perhaps that is why natural history films of such events as the growth of an apple excite so much wonder in our minds. They portray something that involves a remarkable reduction of entropy, and we realise subconsciously that this is very odd. The explanation of it is that it is only part of a total process which involves a large increase in entropy elsewhere which more than counterbalances the reduction of entropy in the growth of the apple. It is only made possible by radiation processes in the sun that provide a flow of energy into the tree, and there are increases in entropy both in the sun and in other chemical reactions in the tree. Thus the low entropy situation in the apple suspended above Newton's head is possible because the universe as a whole (including the sun) is in a low entropy state that is statistically very improbable. It is this fact that permits (though it does not explain) the generation of complexity when energy flows through systems that are far from equilibrium – most commonly in living organisms.

7 Time in Quantum Mechanics

Quantum mechanics provides the necessary theory to describe the motions of very small particles, smaller than atoms. Of course it really applies to the movements of bodies of all sizes, but for things much bigger than atoms it leads to results that are indistinguishable from those of Newton's or Einstein's theory. However for smaller things it leads to results that are totally different, and in many ways baffling to minds brought up on the behaviour of "ordinary-sized" things.

It would be out of place to go into details of how quantum theory arises or how it works. Suffice it to say that it does not allow us to allocate a specific position or velocity to an object, but only to calculate (albeit very precisely) the probabilities of its having a wide range of values of these parameters. These probabilities are given by what is called a "wave-function" calculated via an equation known as Schrödinger's Equation. This gives the evolution of the probabilities with time, but again makes no distinction between the direction of time towards past or future. However, whenever we make a measurement to see what has actually happened then we obtain a specific value of a position or velocity. The wave-function is said to collapse at the moment of the measurement and the value obtained is controlled by the probabilities given by the wave-function at that moment. Further evolution of the system, after the measurement, starts from the actual measured value, not from the previous state of the wave-function. Thus quantum mechanics does introduce a sense of the direction of time from past to fixture, because when the wave-function collapses a newly defined future comes into being. Also the moment of wave-function collapse perhaps has some relationship to our common-sense notion of the present moment.

8 Time in Theology

There is no single philosophy of time to be found in theological thought, but rather a variety of ideas of varying degrees of naiveté and profundity.

The most naive approach has been the idea that time is absolute, infinite in extent in both past and future, and equally applicable in earth and heaven to man and God. It envisages eternal life as a life infinitely extended in time, with souls in paradise, purgatory, or hell existing contemporaneously with those still alive on earth. Life on earth and life hereafter are then two sections of an individual's continuous experience of time, separated by death. It permits the bereaved to regard their loved ones as continuing a parallel existence to theirs, and is an approach in which a soul may be required to spend a finite period in purgatory, measured in years.

The sale of indulgences purporting to give remission of defined numbers of years in purgatory led the reformers to deny the possibility of actions on earth affecting events "in heaven". This need not necessarily have affected ideas on time, but it not only eliminated indulgences but also prayers for the dead. There had always been a sense that the state of the soul at the point of death was vital – hence the need for death-bed confession and repentance - but this feeling was mitigated by the belief that sins could still be atoned after death both by time in purgatory and by the prayers of the faithful on earth. In the more extreme reformed traditions both of these consolations were destroyed, and it was taught that the state of the soul at death was final. As the tree falls so shall it lie. This introduced a new degree of discontinuity between time in this world and hereafter, if not indeed abolishing time altogether in the hereafter, for the denial of the possibility of progress introduces a static situation that is the antithesis of time.

The notion of an absolute time applicable to both man and God has always been held in tension with the idea that God is in some sense outside time. This much more sophisticated and mystical idea is well rooted in the Bible. The Psalmist already knew that his God's experience of time must be different from his own: "a thousand years in thy sight are but as yesterday when it is past and as a watch in the night" (Psalm 90:4). But the clearest and most definite exposition of such an approach is given by St John when he associates Jesus with just such an extra-temporal position: "Jesus said unto them, Verily, verily, I say unto you, before Abraham was I am" (John 8:58). He also dissociates the notion of eternal life from a life of infinite duration: "this is life eternal, that they might know thee the only true God" (John 17:3); so making "eternal" a quality of life rather than a duration.

A general acceptance of the idea that God is outside time seems to have been inhibited by the question of whether God knows the future. This itself is a very biblical idea that is found throughout the Old Testament, and explicitly in the epistles of St Paul who writes of God not only knowing the fixture but of foreordaining it. But it is commonly felt that such ideas deny the reality of human freewill. If I am free to decide what I will do tomorrow, how can God be said to know now before I have decided? However, such objections merely show how difficult it is to argue logically about concepts of time. Anyone who argues in this way shows that they have not taken the starting point seriously – that God is outside time. If this supposition is true then his knowledge of events is not from a point within time. Tomorrow is in my future, but not in his. He can know (timelessly) what I shall freely decide to do tomorrow in just the same way that he can know what I decided to do yesterday, because he is not viewing either of them from the point in time that we call today. This sort of misunderstanding has seriously clouded much theological discussion.

9 An Attitude to Time

In adopting an attitude to time it is necessary to face what it is about life that demands a reasonably satisfying attitude to time, and why for many people it takes on the aspect of an enemy. When we are young time is an ally. We want to develop our powers and abilities, and time may go all too slowly. It is when we face the decline of our powers and the prospect of death that time can easily seem to be an enemy, especially if we cannot believe in the traditional Christian notion that we shall simply survive as self-conscious beings further along the same time-scale.

Traditionally that saw us inhabiting a physical space ("heaven") above the sky, – clearly no longer tenable as anything other than a piece of poetic imagery. Since our discussion of "Einstein's Time", shows that time is as physical as space and cannot even be totally distinguished from it, it is as impossible to suppose that disembodied spirits can inhabit time as that that they can inhabit a spatial location. The alternative of supposing that immortality is living on in the memory of one's friends and in the results of one's activities in life does not really help. One's friends will not survive for long, and it is a rare person whose influence on events is noticeable for many decades after their death. In any case human history itself is bound to come to an end – whether through catastrophe to the earth, or an end to the universe. If our hopes are dependent on time in any form then they are doomed to disappointment.

If we take seriously the Einstein concept of 4-dimensional space-time then we are 4-dimensional beings, and one's physical body at any instant is a 3-dimensional cross-section of one's 4-dimensional self. It follows that death is simply the instant at which one reaches, in one's sequential experience of the time dimension, the "topmost" point of one's 4-dimensional being. Viewed in this way one's death is no more tragic than the top of one's head, whose existence simply means that one is finite in the vertical dimension, while death simply means that one is finite in the time dimension. One can indeed be glad that one is finite in these two dimensions. The top of one's head is not usually one's best feature, and to continue in the vertical dimension, getting bonier and bonier (or even balder and balder!) is not a very attractive proposition. Equally the last years of most people's lives (sans memory, sans teeth, sans everything) do not represent the state in which they would wish to continue to exist for a long, let alone an infinite, time. Viewed from outside space-time (from God's viewpoint) our being "simply exists" as a finite 4-dimensional object. It is only because of the sequential way in which we experience time within ourselves that we appear to come to an end of things.

However we all recognise that life is more than physical happenings, – more than moving about, being bumped into, digesting food, and so on. The important things of life are the things that have meaning (knowledge, goodness, truth and beauty) and cannot be described in terms of the co-ordinates of objects in space-time. In science when something cannot be described in terms of a particular set of co-ordinates we say that it constitutes another dimension, orthogonal to the previous ones. Even in everyday speech this is becoming a familiar concept – whenever a new idea is introduced people nowadays say "that introduces a whole new dimension". This surely is the meaning of "eternal life" (as in St John's phraseology) – this is life eternal that they might know thee the only true God. We are multi-dimensional beings existing in many dimensions outside of and in addition to the four dimensions of the physical universe, and we exist therein eternally because they are not within time. Our extension is not along the time dimension beyond our death but laterally, at right angles both to the time dimension and to the three spatial dimensions of our earthly bodies.

This concept has two further advantages. It means that it is the whole of our life that partakes of eternity, not just the state that we happen to be in at the moment of death. It is a repugnant notion that a death-bed repentance, or the unexpected lack of an opportunity for one, makes all the difference between eternal salvation and eternal damnation. The incompatibility of this with belief in a just God should have warned us long ago that we were barking up a wrong tree. It also revolutionises our thinking about prayers for the dead. Such prayer is clearly not to be thought of as praying about what is happening to them in our "now" or in our future, because these concepts have no reality so far as they are concerned. It is concerned with the extra-temporality of their existence, which means that prayer can bypass the time dimension and enable us to pray for them as they were in our past when it was their present – not of course in the sense of seeking to alter the past, but in the sense of seeking to support them in it. This is along the lines suggested by Charles Williams of "being with the martyr in the flame".

The concept I am proposing does however present us with another philosophical problem, namely that anything outside time would apparently be totally static, and a life without any sort of development would hardly merit the name of life. It is only possible to give a very tentative answer to this, though I think a sufficient one. It is as dangerous to hypothesise about the nature of things outside time as ever it was to do so about conditions in a heaven above the sky, but all that is required to solve the problem is to suppose that one of the “many dimensions in the Father’s house” is one which can be experienced sequentially. This may well be true of a dimension of God’s grace.

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