The Passage of Time

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy by

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DAMAGED TEXT IN ORIGINAL

With love to Mum and Dad

Contents

Preface

This thesis originally came to life under the research title "Time, Timelessness and Creation". Several years ago, on the basis of work done on time, Professor Paul Helm won funding from the University of Liverpool to support a Ph.D. student for 3 years to continue exploring this area. I was lucky enough to be that student.

People sometimes used to joke with me that I could spend one year on each word in the title. But *four* years on, I still haven't got beyond the first word in the title - "time". And even limiting the thesis just to time, it was necessary to focus on one particular aspect. So the final title is simply "The Passage of Time".

Having said that, the thesis is still very wide ranging. Topics covered include: what it means to say time passes; the implications that recent ideas in physics (especially Special Relativity) have for our concept of time; the root problem behind McTaggart's Paradox; the role time plays in language, belief and thought; the status of the past and future; the way objects and people persist through time; freedom and fatalism; our experience of time; whether time has an intrinsic direction; why we know more about the past than the future; and why causes come before their effects.

Something ought to be said about the general organisation of the thesis, in particular the six appendices included at the end. A few months ago, as I was putting the thesis together, I discovered that if I included all the material I had intended to I was likely to break the word limit of 100,000. And not by a few words - probably as much as 50,000! Worse than that, there seemed to be no material that could easily be left out without interrupting the flow of the main argument.

After a very ruthless project of "downsizing" the thesis, I managed to get it down to below the required limit. A lot of material was simply lost. A much-loved chapter of time travel had to go. The material on the direction of time originally formed almost a thesis in its own right and was reduced by well over 15,000 words. More words were lost by removing odd extraneous sections. Finally, careful rewriting and tightening things up brought me within sight of the limit. I made every effort not to make the thesis terse or dense, or to sacrifice clarity, but I apologize in advance if my style in places is less full or fluent that it would usually be.

I would like to thank the following people. Firstly, Paul Helm and Nicholas Nathan for picking me for the Ph.D. to begin with; and to Paul for supervising me for the first year before leaving to take up a post in London.

Special thanks to Dr Barry Dainton, who supervised the thesis after the first year. Barry read umpteen versions of different chapters and came up with many useful comments (not least "use the spellchecker!"). Also thanks for all the games of squash.

Thanks to all the staff in the Philosophy department, especially to Fran and Lourdes who have made the place welcoming and homely.

Thanks to my Grandad, who took a close interest in the thesis, and corresponded regularly with comments and thoughts. In particular, I should thank him for disagreeing with me about almost everything and making me clarify my own point of view.

In Liverpool, thanks to Mrs.Low for providing a home for the time I've been here. To my cousin David for making sure I was up and working in the morning by always phoning me at about 7 a.m., and to my aunt Edna and uncle Arthur for feeding me. To Don, for being a friend and coming up with thoughts about time. And especially to Su.

At home in Sutton, thanks to Heather, Peter and Tom. And especially to Mum and Dad, who apart from anything else supported me through my undergraduate degree. I dedicate this thesis to them.

The Passage of Time

by Duncan Robert Cryle

Abstract

This thesis is an exploration of what is meant by the "passage" of time and whether time really passes in a metaphysical sense. This exploration falls into two main parts.

After some background material, the first part is a discussion of three arguments against passage: the *rate of flow* argument (looking at how *fast* time passes); the *relativity of the present* argument (looking at whether passage conflicts with Special Relativity and other recent ideas in physics); and McTaggart's Paradox. These three arguments together are found to raise serious difficulties for a passage model of time. I also look at a wide variety of recent ideas about what passage consists in (Schlesinger's possible worlds model, Storrs McCall branching-universe tree model, and several others). None of these new approaches make passage any less obscure or problematic.

The second part of the thesis looks at time without passage i.e. the tenseless theory of time. I explore a variety of potential problems for this theory, beginning with the prevalence of tense in our everyday language and the importance of tensed beliefs like "it is *now* raining". Next I look at whether the tenseless theory is compatible with human freedom, followed by a discussion of temporal parts. I devote a lot of space to exploring the vivid sense we have of time passing and how this might be explained on the tenseless view. Finally I look at matters connected with the direction of time. Firstly I ask if time has an intrinsic direction and if this direction is due to passage. Secondly I look at a number of asymmetries in time (why causes come before their effects, why we know more about the past than the future) and explore three ways in which these asymmetries might be explained and related to each other.

The conclusion is strongly in favour of a tenseless theory of time, and I end with some suggestions about why we tend to have such a firm belief in passage.

Introduction and Background

(i) The Passage of Time

Time passes. Clocks go round, day follows day, people are born and grow old and die, empires rise and fall, planets and stars come and go. The passage of time is a central feature of the way we look at the world, something we are aware of almost constantly. In the morning we wake up and have to rush to get ready for work or to go out, because time is hurrying by and 9 a.m. is rapidly approaching. Time crawls along through the day if work is unpleasant or boring, or flashes past if there is a pile of things to do. But no matter how much the day drags time will eventually pass and it is time to go home for dinner. Time slips past inexorably through the evening until it is time to sleep. After eight or so hours of relative oblivion we wake to find that the night is over and a new day is beginning. Day follows day and years slip past in succession. A constant background to all our activities, waking or sleeping, is the way time crawls, drags, rushes or flies.

As well as being one of the most familiar things in our experience, the passage of time is very strange. Many philosopher's have puzzled over this fleeting, dynamic quality of time. Donald Williams writes:

> 'The literature of "passage" is immense, but it is naturally not very exact and lucid ... "passage," it would seem, is a character supposed to inhabit and glorify the present, "the passing present," "the moving present," the "travelling **now**." It is "the passage of time as actual ... given now with the jerky or whooshy quality of transience." It is James' "passing moment." It is what Broad calls "the transitory aspect" of time, in contrast with the "extensive." It is Bergson's living felt duration ... It is Tillich's "moment that is creation and fate." It is "the act of becoming", the mode of potency and generation ... It is Eddington's "ongoing" and "the formality of taking place," and Dennes' "surge of process." It is the dynamic essence which Ushenko believes that Einstein omits from the world. It is the mainspring of McTaggart's "A-Series" which puts movement in time, and it is Broad's pure becoming. Withal it is the flow and go of very existence, nearer to us than breathing, closer than hands and feet." (Williams [1], p.103)

One of the reasons that the passage of time can seem so strange is that a little reflection shows that time cannot literally pass. Although "time passes" seems to express an important truth about time, what does it really mean? When we talk about things passing or flowing or crawling or flying we

are talking about the way things move at a particular *speed* through a region of *space*. Buses and cars pass a particular place (the pub on the corner of the street) at a particular speed (30 mph). If time is passing, *what is it passing*, and *how fast*? The absurdity of these questions show that time doesn't pass in the literal sense in which buses, cars and trains pass. But then what does it mean to say that time passes?

(ii) McTaggart's A- and B-Series

The background against which this thesis is (loosely) set has its roots in a distinction made by J.M.E McTaggart in the course of his attempt to prove the unreality of time. McTaggart writes:

> Positions in time, as time appears to us prima facie, are distinguished in two ways. Each position is Earlier than some and Later than some of the other positions....In the second place, each position is either Past, Present, or Future. (McTaggart, p.24)

This gives two distinguishable (though related) ways of looking at time. One way is to see time as a series of moments and events running from the far past through to the present and towards the future. McTaggart calls this the **A-Series**. The other way is to see time as a series of moments and events running from *earlier* to *later*. McTaggart calls this the **B-Series**. See figure 1.1.

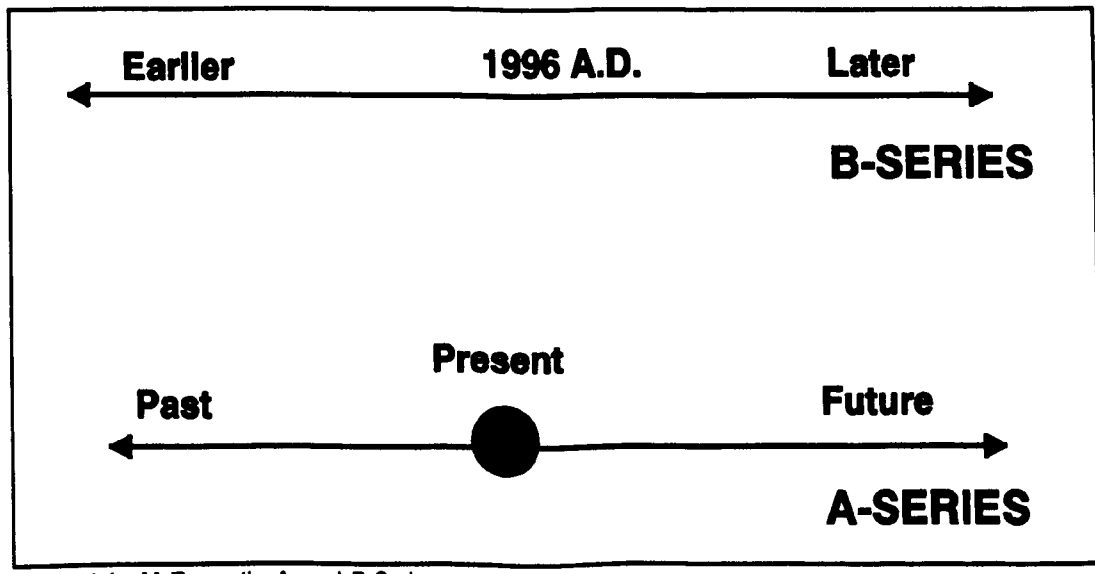

Figure 1.1. McTaggart's A- and B-Series

These two ways of looking at time have importantly different logical features. Consider three events[1]: the death of Socrates in 399 B.C., the event of my now typing this page in 1996 A.D., and the start of the 2004 Olympics. In A-Series terms, the event of my typing this page is *present*, the event of Socrates' death is *past* and the start of the 2004 Olympics is *future*. This suggests that there is a special set of properties that events have - *presentness*, *pastness*, and *futureness*.

As time passes events *change* these properties. Socrates' death was once future; in 399 B.C. it became present; now it is past. The event of my typing this page has the property of *presentness* only fleetingly and will soon be *past*. The changeability of these properties is the reason why A-Series time is sometimes called the *dynamic* or *transient* aspect of time.

Another important feature of McTaggart's A-Series is that we do not need to qualify statements like "this event is present" in the same way that we have to qualify statements like "this man is tall". *Tallness* is a relational term, not a property that someone possesses in themselves. The king of the Lilliputians in Gulliver's Travels is tall, but only compared with other Lilliputians; compared with us he is very short[2]. But *pastness*, *presentness*, and *futureness* are intrinsic properties. If an event is past, it just *is* past, not past in relation to something else.

The B-Series is quite different. Firstly, B-Series relations between events do not change. If Socrates' death is earlier than my typing this page, this relation holds for all time. Socrates' death cannot *move* to being later than my typing of this page. The B-Series, then, is fixed and unchanging; it is therefore sometimes called the *static* view of time.

Secondly, *earlier* and *later* are relational terms, not properties. They are used to say how an event is placed in time with respect to other events. No event is *earlier* or *later* in itself: it is earlier or later *than some other event*.

These differences between the A- and B-Series are summarised in the following the table on the next page.

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[1] Although I use events in my examples, the same point can be applied to moments of time. The year 1995 A.D. can be past, present or future. Similarly we can say things like "1812 A.D. is earlier than 2001 A.D."

[2] Normally we do not bother to qualify statements like so-and-so is tall because we take it for granted that the person is tall *in relation* to what we think of as the normal size for a person. What we mean is in effect that so-and-so *is taller* than most people tend to be.

A-SERIES	B-SERIES
Intrinsic properties of pastness, presentness, and futureness.	Temporal relations of earlier than and later than.
Events and time change from being future to being present to being past.	Temporal relations between events are permanent: if E is earlier than F then E is always earlier than F.

There are various vivid (though potentially misleading) images to show the contrast between the two series. A common image is to compare time to a great river: the static banks represent the B-Series spread of history; our motion as we are carried along by the flow of the river represents the A-Series. Bradley writes:

> We seem to think that we sit in a boat, and are carried down the stream of time, and that on the bank there is a row of houses with numbers on the doors. And we get out of the boat and knock at the door of number nineteen, and, re-entering the boat, then suddenly find ourselves opposite twenty, and having there done the same, we go on to twenty-one. And, all this while, the firm fixed row of the past and future stretches in a block behind us and before us...(Bradley [1], p.54).

Another common image is to think of the B-Series as a long line of events successively lit up by the constantly shifting spotlight of the present. The common feature of these images is the contrast between the "static" B-Series ordering and the "dynamic" quality of the A-Series.

(iii) How Real Are the Past and Future?

As McTaggart characterizes the A-Series it is as if there is a line of equally real events to which the properties of pastness, presentness and futureness successively attach.

But a common feeling is that future events do not yet exist, or exist in only an attenuated sense. To a lesser degree the same feeling applies to the past: past events *no longer* exist, or exist in a weakened sense. Only the

present time, and presently occurring events, are felt to be fully real. The past is *no longer*, the future is *not yet*; only the present *is*.

There is also an inclination to think that there is a difference in reality between the past and the future. The past is no longer present, but it *did happen* and its contents are fixed and unalterable. In this sense, the past has more reality than the future which may be seen as a realm of possibilities, a hazy and ambiguous affair. Many future possibilities will never be realised; a few will come to life in the full glare of the present and then recede into the half-light of the past.

A fairly common sense view of time[3] might be something like this. Only the present is fully real; the past is less real (its contents are fixed, but it lacks the "spark" of presentness); the future is the least real (a hazy realm of possibilities). The advance of the present into the future decides which of these possibilities become present reality and fixed past. See figure 1.2.

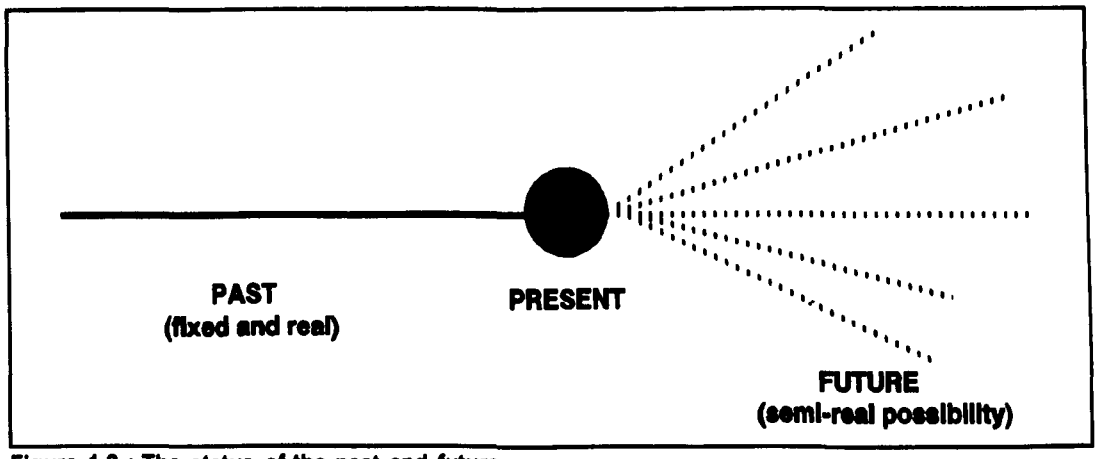

Figure 1.2 : The status of the past and future

(iv) Two Models of Passage

Whether the A-Series aspect of time is thought to be like McTaggart's picture or more like the model shown in figure 1.2, there are two central features: the genuine difference between past, present and future regions of time, and the constant change between them. These two features are inevitably linked to the view that time passes, that there is some sort of metaphysical *passage*. The passage of time must involve some sort of change between past, present and future. And this change requires a

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[3] There probably isn't any such thing as THE common sense view of time. Going by my experience of talking to people about time, I've been very surprised at the diversity of opinions held. What seems a natural common sense view to one person can seem strange and dubious to someone else. But since the model shown in figure 1.2 seems to be as natural and commonsensical as most I will use this as a starting point.

genuine difference: if pastness, presentness and futureness were all the same there would be no change between an event being past or being future. In the rest of this thesis, then, I will use the word "passage" to imply both these features.

In the context of the above discussion "passage" can be unpacked in (at least) two ways. Firstly, we could focus on the way in which events become successively future, then present, then past. "Time passes" could be said to mean just that events constantly gain and shed the intrinsic A-properties of pastness, presentness and futureness. Since this is the picture that McTaggart seemed to have in mind, I will refer to this as **McTaggart-type passage.**

Figure 1.2 could be understood in this way as well, but the image suggests another way of conceiving passage. As time passes, the present moment, the "now", moves across the diagram in the future direction. "Time passes" could therefore be understood to mean the steady advance of the present into the future, the constant progression of the "now" turning future possibility into past fact. I will call this account of passage the **moving-now model of passage**.

(v) Tensed and tenseless time

The distinction between the A- and B-Series originally made by McTaggart is now often made in terms of the **tensed** and **tenseless** views of time. The basic idea behind this approach is that the A-Series is closely linked with the use of *tense*. Consider the following list of ordinary sentences:

(1) Tom *is* in Wales
(2) I *was* at the festival *last night*
(3) *Future* events include a charity walk in Scotland
(4) 1800 A.D. is *in the past*

Sentences like these are used to keep track of the passage of time, the steady progression of events and times from future to present to past[4]. In contrast the following set of sentences more naturally associate themselves with the passageless B-Series:

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[4] Although sentences (1) - (4) all have something in common, there are also interesting differences. For a detailed look at the different forms of sentences we use to locate things in time, see chapter 2 of "Space-Like Time" by F.M.Christensen.

(5) 1801 *is earlier than* 1995
(6) The festival *is at the same time as* my appointment
(7) The bus' arrival *is at 4 p.m.*
(8) St.Augustine is born *after* Socrates' dies

One way to bring out the contrast is to focus on the use of the word "is" in these sentences. "Tom is in Wales" can be naturally replaced by "Tom is *now* in Wales". The *now* emphasizes that the verb "to be" is being used in the present tense form. Contrast this with sentences like:

(9) Two plus two *is* four
(10) The freezing point of water *is* 0 degrees C

The use of *is* in (9) and (10) is distinct from its tensed use in (1). It is strange to say that two and two is *now* four, or *will be* four. The *is* in these sentences is used *tenselessly*. In other words, two and two just *is* four, where this "is" contains no suggestion of the present tense "is now", the past tense "was", or the future tense "will be".

A sentence like (5) is similar to (9) and (10). We don't say that 1801 is *now* earlier than 1995 because this is "always" true. The "is" is again used tenselessly. This applies equally to (6), (7) and (8)[5].

This distinction between tensed and tenseless uses of the word "is" is not primarily to do with grammar. Rather the aim is to point out a significant difference between two common ways of talking about time and of locating events within it. I will look more closely at the precise logical difference between these two ways of talking in Chapter Five "Language and Time". For now it is enough to note the link between tensed and A-Series time, and between tenseless and B-Series time. Tense naturally lends itself to idea that there are intrinsic and changing differences between past, present and future. Tenseless talk naturally reflects the "permanent" B-Series. From now on I will use the terms "A-Series time" and "tensed time", and "B-Series time" and "tenseless time" interchangeably.

[5] (7) and (8) sound awkward and odd. This is because in ordinary talk tenses would be used: we would say "the bus arrived at 4 p.m." and "St.Augustine *was born* after Socrates' *died*". But despite the usual way of "tacking on" a tense to these sentences, what they express are mainly permanent B-Series truths.

(vi) The importance of passage

I have outlined a broad distinction between two ways of looking at time: the A-Series/dynamic/tensed view and the B-Series/static/tenseless view. What is the relationship between these two aspects of time? Is one more fundamental than the other, or are both equally necessary?

Since "time passes" appears to express such a deep truth about time, and since only the A-Series provides a model for this passage, it seems at first sight that the A-Series is the most fundamental. This idea (that time is fundamentally an A-Series and that the B-Series aspect is derivative) is made more appealing by looking at how important the notion of passage is in our ordinary view of the world. Below are just three examples.

(1) everyday speech. Tense pervades the way we talk. From phrases like "past" and "future" through to every verb we use (e.g. arriv*es*, arriv*ed*, arriv*ing*) the passage of time is taken for granted. How would we make sense of the three simple sentences "Tom will be in Wales", "Tom is in Wales", "Tom was in Wales" if time didn't (in some sense) pass?

(2) experience of passage. Sitting quietly looking at a clock, or listening to the beat of our hearts in the middle of the night, we can almost watch and feel time slipping away. The constant change in what we are perceiving and experiencing, the constant growth of our store of memories, all seem to be a direct result of the passage of time.

(3) freedom and action. Hardly anyone thinks that they can change past events by what they do now, or to cause something to have already happened. A natural explanation of this is in terms of the difference in reality between the past and future. Whereas the past is "fixed and unalterable" the future is still "open". I can still decide to go out tonight because tonight is still part of the changeable future. But time passes and tomorrow morning "tonight" will be part of the past, beyond my power to change. It appears to be the "open" nature of the future that explains why we are free to act to affect the future.

(vii) Problems with passage

The obvious importance of passage leads to a difficult dilemma. The problem is that, although passage is so fundamental to our ideas about time, it is also a very obscure and difficult notion. Numerous arguments have been put forward to suggest that the passage of time is either literally absurd, riddled with contradiction, or impossibly confused.

McTaggart again provides a useful starting point to explore this problem. Although he argues that the A-Series is essential to time, he also argues that *the A-Series is contradictory*. The argument he uses to show this is known as **McTaggart's Paradox**. For McTaggart the consequence of this paradox is clear:

> The reality of the A-Series, then, leads to a contradiction, and must be rejected. And, since we have seen that change and time require the A-Series, the reality of change and time must be rejected. And so must the reality of the B-Series, since that requires time. Nothing is really present, past, or future. Nothing is really earlier than or later than anything else ... When we perceive anything in time - which is the only way in which, in our present experience, we do perceive things - we are perceiving it more or less as it really is not. (McTaggart [1], p.34)

McTaggart tries to mitigate this extreme conclusion by pointing out that the denial of the reality of time has been a common theme throughout the history of philosophy, religion and mysticism. But not surprisingly few people have been willing to accept this view!

McTaggart's work prompted a variety of responses. Some philosophers try to show that McTaggart's argument against the A-Series doesn't work. Other philosophers feel that, while the argument shows that traditional ways of conceiving the A-Series are flawed, it is possible to construct quite different models of time that allow for passage but avoid McTaggart's Paradox.

A third response, which at first sight seems as implausible as denying that time is real at all, is to accept that McTaggart has shown that the A-Series is contradictory and that therefore *there is no passage of time in any metaphysical sense*, but nevertheless claim that time is still real. In terms of McTaggart's distinction, the claim is that the A-Series is not essential to time after all: the B-Series alone is sufficient. Events could be earlier and later than one another, despite the fact that it is not the case that events are

past, present, or future. The importance of passage is a serious obstacle to this view. Anyone taking this third option would have to explain why tense pervades our everyday language, why it *feels* as if time passes, and many other things.

McTaggart's Paradox is not the only argument against passage. Passage has seemed to many people to be a deeply obscure and problematic concept. Again (assuming that the conclusion that time is unreal is not an option) there are three possible responses:

(1) Refute the arguments. Show that any problems that the notion of passage suffers from can be properly solved.

(2) Accept that the arguments may affect certain conceptions of passage (e.g. traditional McTaggart-type passage and the moving now model of passage) but suggest a new model for passage which is not as problematic.

(3) Accept that passage is a highly obscure and problematic notion, but argue that passage is not a necessary feature of time. To do this it has to be shown that passage-less time is a plausible option.

(viii) Overview of the Thesis

This thesis tries each of these three options in turn. In the first three chapters I will look at three main arguments that raise problems for the idea of passage.

The starting point of Chapter One, "How Fast Does Time Pass?", is whether it makes any sense to apply words like "passing" and "flowing" to time itself. The most common way in which we speak about "passing" and "flowing" refers to processes that take place *in time*. Buses and cars pass, rivers flow. Isn't it absurd to talk about time doing the same thing?

Chapter Two, "Relativity and Passage", explores what implications our current scientific theories may have for our ideas about time and passage. The focus of the chapter is Einstein's Special Theory of Relativity. After outlining some of the basic ideas of Special Relativity, I develop what I call the *Relativity of the Present* argument. This argument reveals a difficult conflict between Special Relativity and passage. At the end of the chapter I will briefly touch on General Relativity, Quantum Theory, and a few other matters.

Chapter Three "The Unreality of Time" explores McTaggart's Paradox, probably the most famous and controversial argument against passage. I look at several different versions of the paradox. Then I explore the sources behind McTaggart's argument, and ask whether there is really any paradox involved at all.

Chapter Four "New Models of Passage" turns to the second option. Since the first three chapters raise many difficulties for traditional ideas of passage, perhaps some alternative models are possible. In this chapter I outline and explore some of these alternative models - for example, Schelsinger's possible worlds model of passage, and Storrs McCall's branching universe-tree model. In each case I examine whether these alternative models avoid the arguments of the previous chapters and look at how plausible they are.

From Chapter Five onwards I begin to look at the third response - the B-Series or tenseless view of time. After briefly outlining the B-Series view of time, I list some of the main problems this view faces. In Chapter Five "Language and the Passage of Time" I examine what sense can be made of our everyday use of tense if there is no metaphysical passage. Can tensed sentences like "It is now raining" or "I will be going out tonight" be replaced by tenseless sentences? Do tensed sentences need tensed facts (facts about pastness, presentness and futureness) to make them true i.e. is the sentence "It is now raining" made true by the fact that the rain has the metaphysical property of *being-present*? As well as language, I also look extensively at belief. Many of our beliefs are tensed e.g. the belief that it is now one o'clock. What are we to make of these tensed beliefs if time is really tenseless?

Chapter Six "Miscellaneous Problems" looks at two main puzzles. The first part of this chapter looks at freedom. On the tenseless view the future is as real as the present. If the future is "already" there, how can I be free to act as I please? For this reason, the tenseless view of time has sometimes been thought to imply fatalism. The second part of this chapter turns to problems to do with our identity over time, and in particular asks whether we have *temporal* as well as spatial parts like arms and legs.

Chapter Seven "Our Experience of Passage" explores the experience we have of time passing. Time simply *seems* to pass. I explore how this sense of passage might be explained if there is in reality no metaphysical passage.

Chapters Eight and Nine are a discussion of the *direction* of time. Time seems to have a clear direction running from past to future. This is suggested by many time-biased phenomena: causes come *before* their effects, we tend to know more about the past than the future, we worry more about a future trip to the dentist than a past one. The forwards flow of time associated with passage seems ideal for explaining this direction: time runs *from* the past *to* the future. But how can the direction of time be explained if time does not pass or flow in this way? Chapter Eight, "The Intrinsic Direction of Time", looks specifically at whether time itself is directed. Chapter Nine, "Asymmetries in Time" focuses on the marked direction of things *in* time (why causes come before their effects, etc).

Finally, in the "Conclusions", I try to draw together what has been learnt, and make a decision about what we should make of this difficult idea of the "passage" of time.

Chapter One

How Fast Does Time Pass?

(i) Introduction

The most immediate problem with the passage of time is whether it makes sense to talk about time passing or flowing. Words like "passing" and "flowing" usually apply to processes that take place *within time*. It seems absurd to use these words to describe time itself.

A vivid way to see the problem is to ask some ordinary questions that should make sense whenever we talk about something passing. If time passes, how fast does it pass? Could the rate at which time passes speed up or slow down? Could time stop passing and come to a halt? What places does time pass through? In what direction is time heading? It is not clear that any of these questions have sensible answers. Should we answer that time passes at 20 mph or 100 mph, or starts off at 10 mph and accelerates up to 90 mph? Should we say that time passes through London and Crewe, and is heading north towards Liverpool? These answers are not wrong just because I have suggested the wrong speeds or towns. They are wrong *in principle*: no answers of this sort could ever be right.

Some philosophers have held that the silliness of these answers show that the statement "time passes" is absurd. Time is not the sort of thing we can talk about passing or flowing. In this chapter I want to explore what makes these answers so peculiar, and what implications their literal absurdity has for the idea of passage.

Since the way that these arguments are usually introduced is with the question "how fast does time pass/flow?" I will call arguments of this general sort **rate of flow arguments**.

(ii) How Fast Does the "Now" Move?

If we think first of passage in terms of the moving-now model, the "now" moves steadily into the future. The problem is to understand what is meant by describing the "now" as "moving", "advancing", "flowing" or whatever term is used. All these terms are *motion words*. The standard use for them is to describe how ordinary objects move. A soldier advances; a car moves; a river or stream flows.

More precisely, we use these words to describe how objects move through space over a period of time.

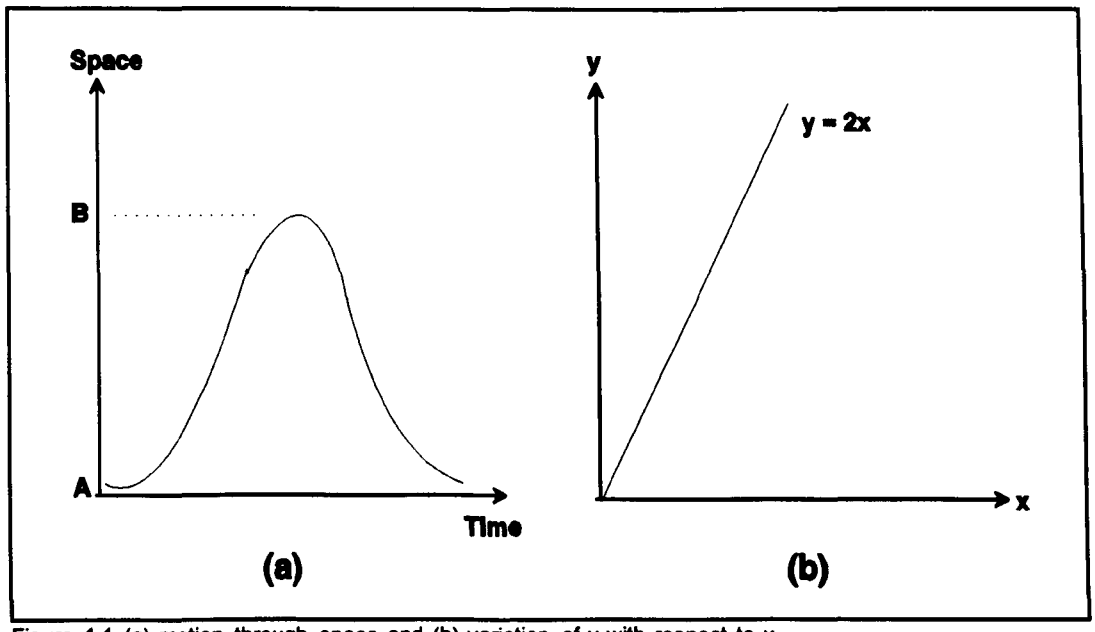

Figure 1.1 (a) motion through space and (b) variation of y with respect to x

say that a car is moving implies that

it crosses x units of space during y units of time. The motion of the car can

be plotted on a graph. See figure 1.1(a). The horizontal axis represents time and the vertical axis space. The graph shows the motion of a car as it accelerates away from A, drives a short distance to B, turns and returns to A.

The point this graph illustrates is that if a car is moving, it is moving through space *with respect to the time dimension*. The car's motion simply could not be plotted if we used the space-axis on its own. In order to chart its motion the time-axis is needed as well. It is by charting the places which the car occupies *at successive times* that we can make sense of the idea that the car is moving. We can also say *how fast* a car or bus is moving by looking at how many units of space (miles) the car covers over a period of time (one hour). If a car covers 30 miles in one hour we say that it is moving at 30 mph. Using the same set-up we can also talk about the car accelerating and slowing down.

I have just outlined the standard use of words like "moving", "accelerating" etc. Clearly this cannot be the sense in which the "now" moves. The "now" doesn't move through space (e.g. from the corner shop to the centre of town). It doesn't accelerate and turn around. This would be absurd!

(iii) Secondary Uses of Motion-Words

The fact that it is absurd to talk of the "now" moving in the primary sense of the word "move" outlined above, does not automatically mean that the motion of the "now" cannot be made sense of in any other way. Although the standard use of motion words is to describe motion through space over a period of time, there are other situations in which it makes sense to use words like "moving" and "flowing".

In geometry, a function like y = 2x can be plotted on a graph using an x- and y-axis. See figure 1.1 (b). *This graph shows how the value of y varies with respect to the value of x.* It *does* make sense in this situation to talk about the value of y *changing* (if not moving) with respect to x.

Now suppose that we plot a graph on these axis to show the way a given road rises and falls. The vertical axis charts the height above sea level

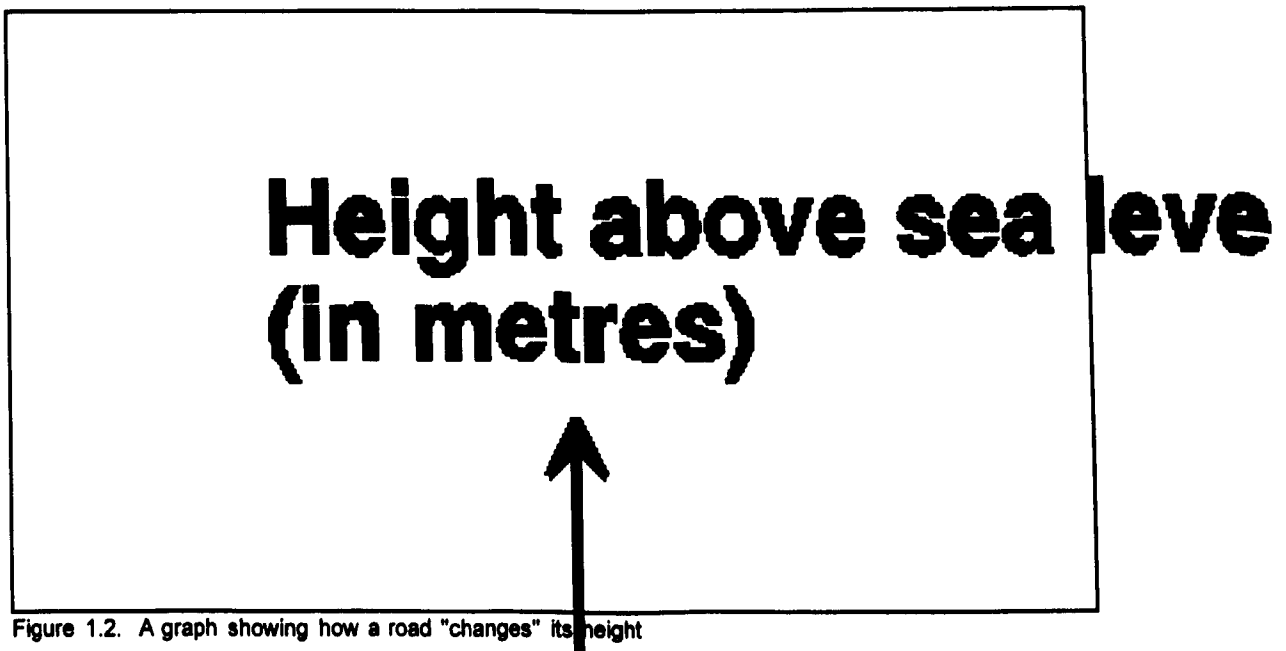

Figure 1.2. A graph showing how a road "changes" its height

of the road; the horizontal axis charts the distance along the road. The graph therefore shows the height above sea level of the road at each point along its distance. See figure 1.2. The road starts off by the sea, winds up into some inland mountains, then drops into the plains. We can imagine someone pointing to the graph and saying something like: "Here, where the road starts, it is only 5 metres above sea level. As we move inland, the road *rapidly rises.* When we come to the highest point in the mountains the level has *moved up* to 600 metres. The roads *sinks evenly* down to the plain until it has *moved* back down to 100 metres above sea level".

It makes sense to talk about the height of the road moving, and even of the rate at which it moves, even though this motion is different to the motion of a car. So it may be that it makes sense to talk of the "now" moving even if the "now" does not move in the literal sense in which a car moves. All we need is to explain in precisely what sense we mean that the "now" moves.

(iv) Meta-time

One suggestion is to point out that the "now" moves through time, not space. And this is sensible: of course the "now" moves through time; not through space like a car or bus. The problem is that when an object moves through space it moves with respect to the time dimension. Likewise, when the value of y varies, then this variation can only take place with respect to the x-dimension. In general, we can see that *whenever there is "motion" in whatever sense, there has to be a dimension with respect to which this motion takes place.*

Suppose that one point in the y-dimension is privileged above all the others. Imagine that this privileged status migrates steadily from one point to another. If we dignify the privileged point by Y (capital y) then we have a "moving-Y". To plot its motion we need the x-dimension i.e. we need to plot the position of the moving-Y against values of x. See figure 1.3 (a).

This situation is similar to the idea of a privileged "now" moving from one point of time to another. We can simply replace the y-axis with time, and replace the moving-Y with the moving "now". We saw above that it is only possible to chart the motion of the moving-Y *with respect to the x-dimension.* To plot the movement of the "now", then, we need some substitute for the x-dimension.

Motion, in our ordinary understanding, is motion *with respect to time.* Clearly the "now" cannot move through time with respect to time. This would be like the value of y varying with respect to the value of y i.e. trying to show the motion of the moving-Y using *only the y-axis!*

Since the ordinary time dimension will not do, one idea is to postulate a *second time dimension* or *meta-time.* See figure 1.3 (b). The motive behind this suggestion is the thought that when we usually talk about motion we are talking about motion through space over time. Our paradigm examples of change and motion take place with respect to time. In other words, the primary arena of motion is the time-dimension. Since the "now"

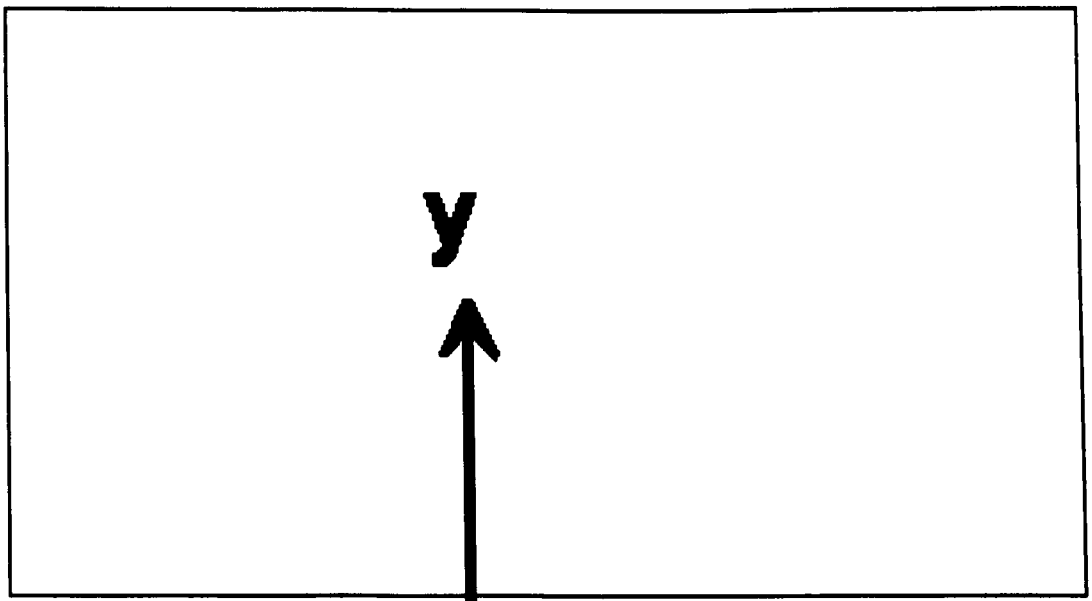

Figure 1.3 (a) the moving-Y and (b) the moving-now

cannot move with respect to the usual time dimension, the nearest we can get to this paradigm sort of motion is to postulate a second time dimension - a meta-time - with respect to which the "now" moves through the ordinary time dimension. Although this may seem an odd suggestion, it is at least one candidate for the dimension we are looking for. If this dimension is not meta-time it is unclear what else could be suggested.

Suppose, then, that the "now" moves with respect to meta-time. We can then say that the now is at 1st January 1995 at time t_1 of meta-time, but at 1st January 1996 at time t_2 of meta-time. And it will move at a rate of one second per x units of meta-time (the value of x would depend on the units of meta-time chosen as that at which the "now" moves with respect to meta-time).

But there is a problem here. *Meta-time* is postulated just because it is *similar enough* to ordinary time for it to make sense to say that the ordinary "now" moves with respect to it. But the original motive for postulating meta-time was to defend this notion of a moving "now", since it is felt that this moving "now" is an essential feature of time: it is what gives time its passage. But if meta-time is similar to ordinary time, shouldn't there be a *meta-now* moving through *meta-time*, making first one *meta-moment* present, then another?

If so, everything repeats at a higher level. With respect to what dimension does the *meta-now* move? The answer must be a *third* time dimension, which will again suffer from the same problems. Postulating a *meta-time* to help make sense of the moving "now" is the first step down a slippery slope. The end result is an infinity of nested time-dimensions: the

moving "now" moves with respect to the second time dimension, the "now" of this second time dimension moves with respect to a third time dimension, the "now" of this third time dimension moves with respect to a fourth time dimension, and so on.

(v) McTaggart-Type Passage

Suppose we drop the idea of a moving-now and concentrate on McTaggart-type passage. The passage of time now consists in events becoming successively future, present and past: events *change* their properties from *being-future* to *being-present* to *being-past*.

But although there is no talk of motion here, essentially the same problems apply. Motion is only a special case of change (the change of spatial position with respect to time). The primary use of the word "change" refers to changes *with respect to time*. If a door is white and is painted black, this change from white to black takes place within time. See figure 1.4 (a). The problem again is that we cannot talk of events "changing" their temporal properties in any ordinary sense of the word.

Why can't this change be an ordinary change within time? Suppose that at one time all events later than the Battle of Hasting are future, all events earlier are past, and all events at the same time are present. We can draw time as a strip divided up into three regions as in figure 1.4 (b). At another time (e.g. when the Great Fire of London is present) this line will be divided differently. In some sense there has been a *change*: the division of time into past, present and future regions has altered.

Now consider how this changing distribution between past, present and future can be plotted. The change in the way time is divided up *is a change in time itself*. Therefore the change cannot take place with respect to time. A second dimension is needed, with respect to which the distribution alters. The only clear option is to follow the same course as above and postulate a *meta-time*. See figure 1.4 (c). But the same regress swiftly follows. If meta-time is enough like time to be the dimension with respect to which properties changes, then times and events in meta-time must also be past, present and future and constantly be altering these properties. This *second-level* change will then have to be made sense of by postulating a third time dimension.

The point is that *change-words* and *motion-words* are standardly used to describe things that happen *in time*. Without introducing the difficult idea of meta-time, it is not clear in what sense these words can be used to

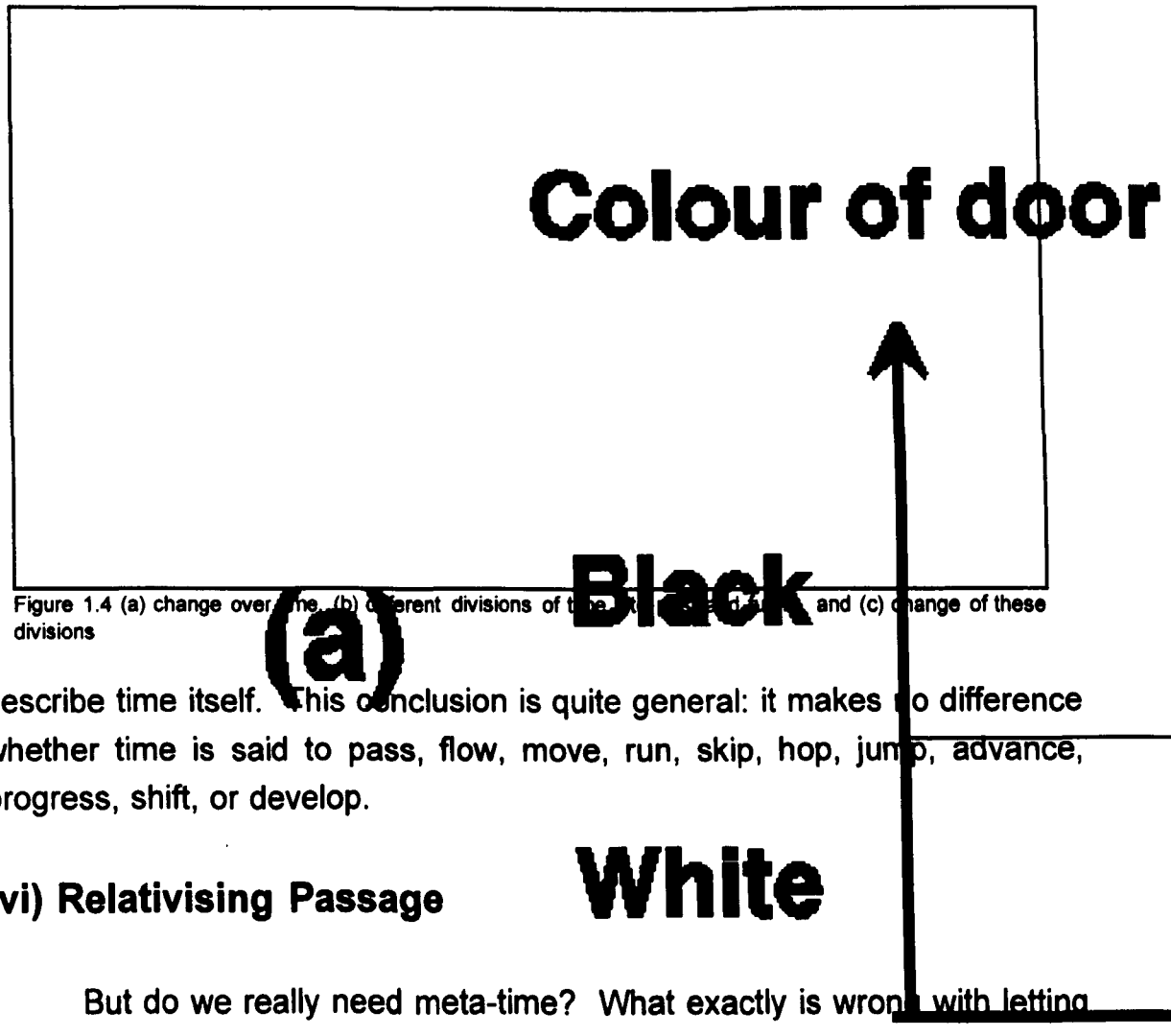

Figure 1.4 (a) change over time, (b) different divisions of the [illegible] and (c) change of these divisions

describe time itself. This conclusion is quite general: it makes no difference whether time is said to pass, flow, move, run, skip, hop, jump, advance, progress, shift, or develop.

(vi) Relativising Passage

But do we really need meta-time? What exactly is wrong with letting this change take place with respect to ordinary time? There seems to be some sense in saying that the movement of the "now" consists in the fact that at t_1 the "now" is at t_1, at t_2 the "now" is at t_2, and so on. And if someone asks how fast the "now" is moving, then the answer is that one second from now the "now" will be one second further along in time. So the "now" is moving at one second per second. Using McTaggart-type passage we could say (even more plausibly) that time t_1 is present at t_1, whereas t_2 is future at t_1; and at t_2 time t_1 is past, whereas t_2 is present; and so on.

Taking McTaggart-type passage first, any plausibility that this suggestion has is brought about, I think, by an *ambiguity* in statements like "time t_1 is present at t_1". The ambiguity is to do with whether "at t_1" is taken to be referring to an A- or B- series location in time.

If it is taken as referring to an A-Series location then "at t_1" means essentially "when t_1 is present". So the claim that "t_1 is present at t_1" becomes "t_1 is present when t_1 is present". This is true, but trivial. Since passage is a deep truth about time, there must be more to it than an empty tautology.

If "at t_1" is taken as picking out a B-Series location, the variation of the

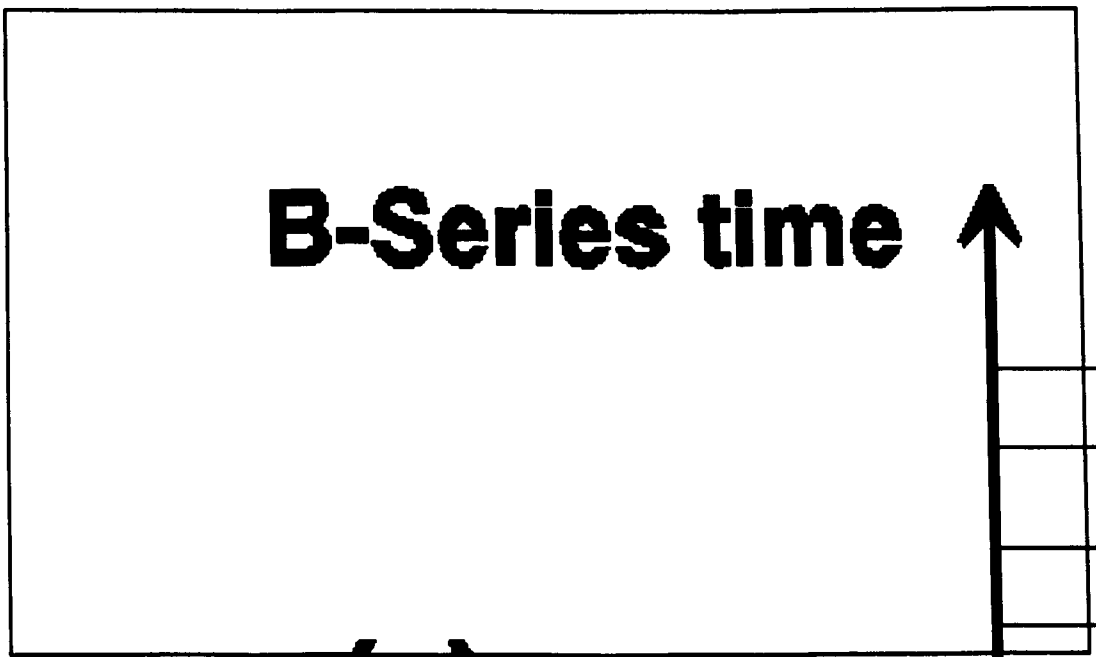

Figure 1.5 (a) relativising McTaggart-type passage to tenseless time, (b) relativising the moving-now model of passage to tenseless time

A-Series is seen as taking place with respect to the B-Series. See figure 1.5 (a). At moment t_1 on the B-Series line, t_1 is present; moments further up the line are future, and moments further down are past. At moment t_2 on the B-Series line t_2 is present, t_1 and all other earlier times are past, and all later times are future. So at each different moment on the B-Series line there is a different distribution between past, present and future.

But this solution effectively removes passage by *relativizing* A-properties to B-Series times. Consider for example "t_1 is present at (the B-Series time) t_1". Since the presentness of t_1 is being placed at a point of B-Series time the "is" in the above sentence should be construed tenselessly: "t_1 *is tenselessly* present at (the B-Series time) t_1". But the B-Series ordering is "permanent". This means that if t_1 is present at (B-Series) t_1, then it is "always" present at t_1. Similarly, t_2 *is tenselessly* present at t_2.

This means that no moment is ever successively present one of another point of the B-Series. Quite generally, for any A-Series moment t_x, t_x is tenselessly present at B-Series moment t_x. But this destroys all the main features of passage. Firstly, presentness is no longer a non-relative

property[6]. There is no one moment of time that has the unique privilege of being present *simpliciter*. Secondly, there is no change. *All* times are "always" present: the only qualification is that each time is present at a different B-Series location.

Similar points apply to the moving-now model of passage. See figure 10.5 (b). The statement "at t_1 the now is at t_1" is again ambiguous. If t_1 is an A-Series time then "at t_1" means "when t_1 is present". But t_1 is present just when it is occupied by the "now". So the claim "at t_1 the now is at t_1" means only "when the now is at t_1 the now is at t_1". But passage cannot be such a trivial claim.

If t_1 is a B-Series time, then the claim becomes "at t_1, the now *is tenselessly* at t_1". This is an unchanging B-Series truth. The "now" is always at t_1 at t_1. And in general, for any time t_x, the "now" is tenselessly at t_x at t_x. Again this destroys the essential features of passage and the A-Series. The "now" does not occupy any one time to the exclusion of all other times; nor does it move from one time to the other.

Despite the appearance of sense in thinking of the "now" moving or A-properties changing with respect to ordinary time, this suggestion doesn't work. Either we are left with a tautology which says nothing about passage; or the dynamism of the A-Series is reduced to a static difference about which tenseless facts obtain at which times.

(vii) Pure Becoming

The source of all the above problems began with realising that the way that we use words like "passing", "moving", "changing", "becoming" is to describe things which take place *in* time. Applying them to changes in *time itself* leads to all sorts of difficulties. As Gale writes:

> Paradox will always result from applying temporal concepts to time ... it is meaningless to speak of new events as always or continually becoming present or of the present as continually shifting ... What time makes it possible for us to say is exactly what cannot be said about time (see Gale [2], p.242-3)

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[6] The same applies to pastness and futureness. If time t(1) is present at t(1), then at later time t(2) this time will be past. In other words, it will be an unchanging truth that t(1) *is tenselessly* past at t(2). Extending this argument still further would show that all times are tenselessly past, present and future at different B-Series locations.

The moral is that talk about the passage of time must be highly metaphorical. Neither change-words or motion-words can be literally applied to "changes" in time itself. The "now" cannot move in the way in which a car or bus moves. Events cannot become present in the way in which a traffic light becomes green, or a boy becomes a man. Even though it was recognised that there are situations in which we talk of motion and change that do not fit this primary usage (e.g. the rising and falling of the road along its length) no analogous way was found to explain why we say that the "now" moves. The best suggestion appealed to meta-time; but this turned out to be a problematic idea.

Most philosophers recognize that "passage" is a metaphor, not literally like the "passing", "moving", or "flowing". To distinguish the passage of time from the way cars and buses pass, a large variety of names have been invented. Passage has been called *pure becoming* or *absolute becoming*.[7] Instead of change *in* time it is described as change *of* time[8]. More often the language in which passage is talked about becomes obscure and poetical.

The motive for these new terms is clear: the above arguments show that passage cannot possibly be like ordinary passage, motion or flow. But I do not think that the force of these arguments is always appreciated. It is not simply that time does not pass in the way that cars and buses pass, or that the "now" does not move through space. Even when motion and flow are taken in a wider and more metaphorical sense they cannot apply to the passage of time. The examples I gave of the varying height of a road along its length, or the variation of the value of y with respect to the x dimension, use motion-words and change-words in this wider sense. But it was shown that passage cannot be made sense of even along these lines.

When a metaphor is used it should be possible to explain (or have an understanding of) what underlies the metaphor. If I say to you that it's raining cats and dogs, then you know that I don't mean this literally. But you will understand that it is raining so heavily that the drops feel almost like cats or dogs falling from the sky. Or if I call you a tower of strength, I don't literally mean that you are a 100 foot tall stone tower. Roughly, I am saying that you protect me from all the troubles I am suffering, just as a strong tower protects people from invading armies. When I say that the height of the road "moves up" to 600 metres, I do not literally mean that some mythical entity "the height

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[7] For example, by C.D.Broad and Richard Taylor.

[8] By David Zeilicovici.

of the road" floats upwards to 600 metres above sea level. What I mean is that at one point the road is quite near to sea level but further along it is 600 metres above sea level. "Moves up" has a metaphorical element, linked to the way my finger moves as I trace the graph, or the way a car would move if it drove along the road.

But what if I say that time passes or flows; that the "now" moves or advances; that events "change" temporal properties? The above discussion has shown that *whatever is meant by saying that time passes or flows cannot be remotely like what is meant by a car passing or a river flowing.* If I am asked to explain what underlies the metaphor, then I am completely stuck. I am driven to inventing names like "pure becoming". But if pure becoming is anything like ordinary becoming then it cannot literally apply to time. And if not, then it is a completely unexplained metaphor. Thus "passage" is entirely obscure: it is not at all clear what underlies this metaphor. So claiming that passage is a metaphor is essentially to jump from the "frying pan" of literal absurdity into the "fire" of obscurity.

(viii) Conclusions

The *rate of flow* argument has left us with two main options. Option (1) is that change-words are used in a literal sense. This verges on absurdity - time cannot "flow" or "pass" in anything like a river flows or a car passes; the "now" cannot move from time to time the way a bird flies from one branch to the next; events cannot "change" or "alter" their temporal properties. Even when change-words are used in a wider way, neither the motion of the "now" or the change of A-properties can be made much sense of. Option (2) is that change-words are used in a highly metaphorical sense. To avoid the near-absurdity of option (1) language has to be bent to a point to which it is no longer clear what is being talked about. The words cannot be taken literally, but this only leaves the "processes" involved obscure.

Both these options are very unsatisfactory. (2) is the best option, since it only convicts passage of obscurity, not absurdity. But the obvious path to take is to look for a third alternative. What is needed is an account of passage that is both free from literal absurdity, and that avoids obscure metaphor (or at least gives some clues about the reality underlying any metaphors used). In Chapter Four I will look at a variety of candidates. For the moment I will just note the difficult problems that the *rate of flow* argument causes for the two traditional models of passage I have considered.

Chapter Two

Relativity and the Passage of Time

(i) Introduction

In this chapter I will be exploring some of the implications that various modern ideas in physics have for passage. The main area of discussion will be Einstein's Special Theory of Relativity. I will give a fairly detailed account of Special Relativity, concentrating on the most relevant philosophical aspects. I will then present and discuss a striking argument based on Special Relativity that raises serious problems for passage. I call this the **relativity of the present** argument.

After treating Special Relativity, I will look briefly at a variety of other recent ideas in physics (for example, the possibility of closed time and wormholes in General Relativity and "backwards causation" in quantum theory). I will use these in what I call the **inflexibility** argument against passage.

(ii) Approaching Relativity: Peculiar Facts About Light

In the account that follows I only aim to provide basic details about Special Relativity, emphasising the philosophical moves involved. The idea is to explain just as much about Special Relativity as is necessary to understand the problems it raises for passage. For more detailed discussion I refer the reader to "An Introduction to the Philosophy of Space and Time" by Bas Van Fraassen (chapter V). Another good philosophical account is in "Space, Time and Spacetime" by Lawrence Sklar, (Chapter IV). For a more mathematical presentation, see G.J.Whitrow's "The Natural Philosophy of Time", or "Spacetime Physics" by Taylor and Wheeler.

Central to Einstein's theory are ideas about how light behaves. The usual place to begin is the Michelson-Morley experiment of 1887. The aim of this experiment was to discover the Earth's motion relative to the æther, a subtle kind of substance thought to pervade space and provide a medium through which light waves could be propagated.

The æther was held to be at rest in absolute Newtonian space. Usually when we specify an object's position in space, we describe where it is in relation to other objects: the coat is *next to* the door; the Himalayas are *to the north* of Delhi; the Earth is 90,000 million miles *away from* the sun. Newton held that underlying all these relative positions is an absolute space, in relation to which objects have non-relative positions. Similarly, Newton held that underlying our relative description of *times* (such as December 2nd is *later than* December 1st, this interview was *shorter than* the last interview) there was an absolute time. Because of our relative descriptions of locations in space and time, the motion we describe is usually relative. When a car drives past it is moving relative to the Earth's surface; the Earth itself is moving relative to the sun and other planets; our solar system is moving relative to other stars; and so on. In contrast to this, *absolute motion* is the non-relative motion an object has with respect to absolute space and time. It is in this absolute sense that the æther was held to be at rest.

Michelson and Morley's idea was that, since the Earth was thought to be moving with respect to this æther, the Earth must also be moving at the same rate with respect to absolute space. So by finding the Earth's speed relative to the æther, the Earth's absolute motion could be discovered. Now, the æther is the medium in which light rays are propagated. Michelson and Morley reasoned that if light rays were sent on round trips of equal distance but in different directions, they would take different amounts of time to complete their trip.

A useful comparison is to imagine two people rowing on a river with a strong current. They both row an equal distance away from a given point and then back again. But one rows in a direction perpendicular to the current; whereas the other rows downstream and then upstream. If both are equally good rowers, the one who rows across the current will return to the starting point before the one who rows downstream and then upstream. See Van Fraassen [1] p.143-146 for a simple mathematical presentation of this result.

The same calculations also work for light in the Michelson-Morley experiment as set up in figure 2.1. Light rays from a source are sent towards each mirror and then reflected back to the source. If the whole apparatus is at rest with respect to the æther then the two rays should return to the source simultaneously; but if (as in the diagram) the apparatus is moving with respect to the æther, *the rays should return at different times.*

The shock result was that the time taken for the round trips were the same. The experiment was repeated at different times throughout the year,

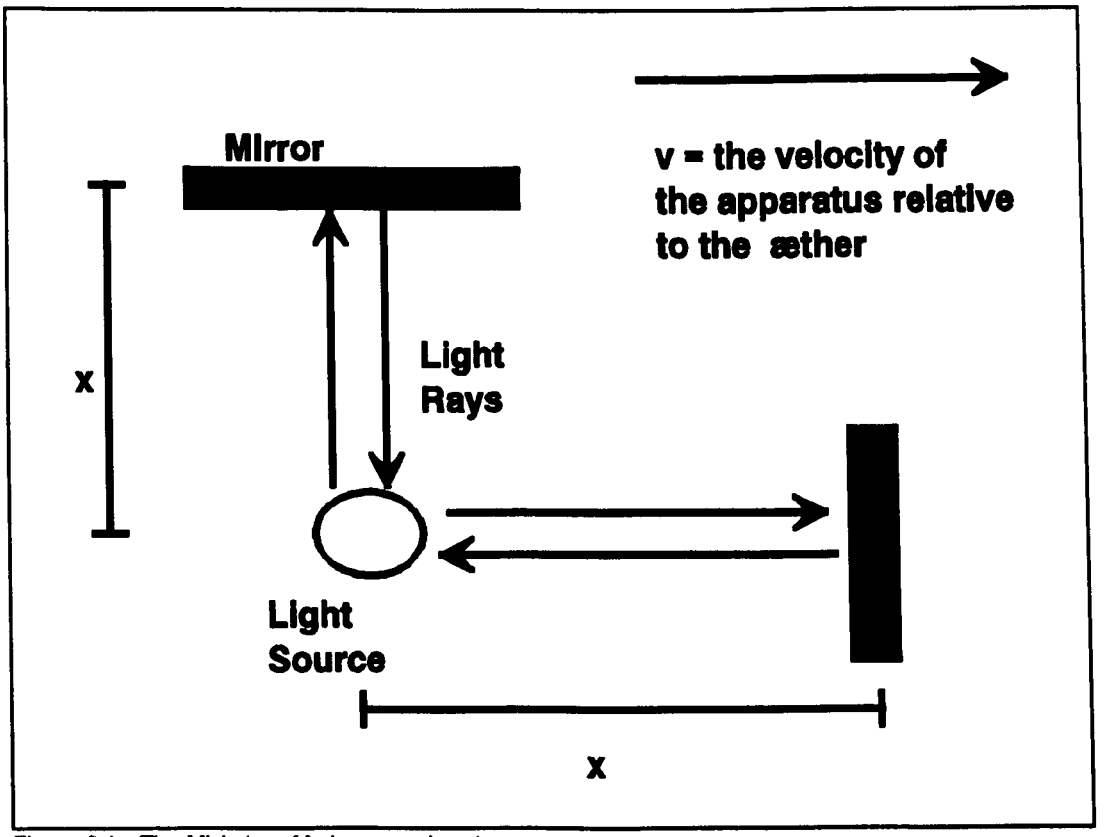

Figure 2.1. The Michelson-Morley experiment.

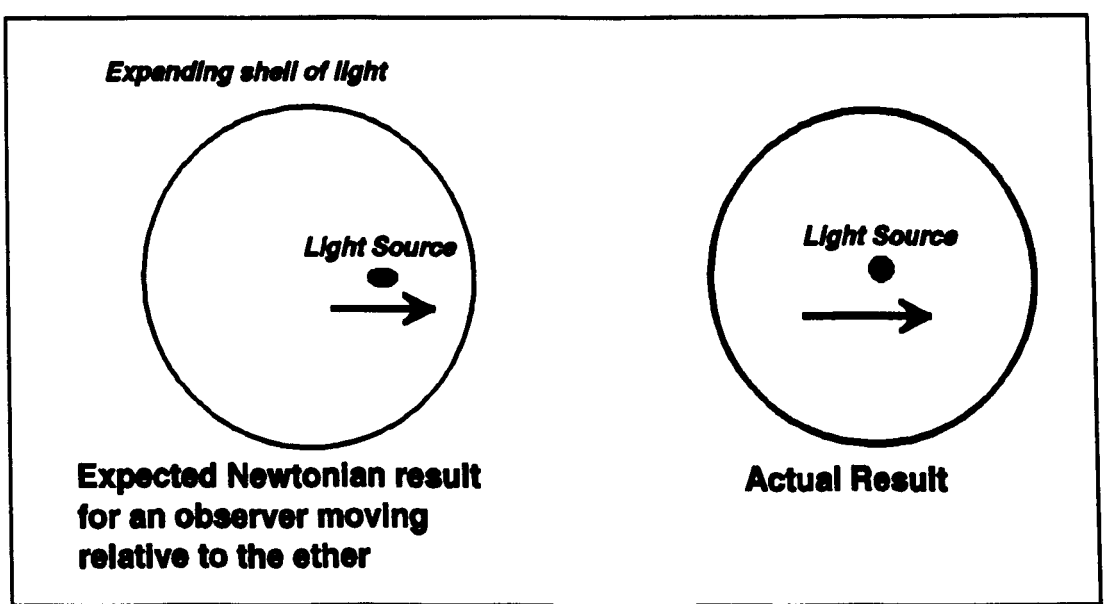

Figure 2.2. Expanding light around an observer according to Newton contrasted with the actual result obtained by the observer.

when the Earth's absolute motion should have changed (due to its orbit of the sun). The results were again the same.

This was odd. It suggested that light moves away from an observer at the same velocity in every direction *regardless of the absolute motion of the observer.* A graphic way of showing the strangeness of this is to imagine a observer shining a light all around himself. If he is moving with respect to the

æther, one would expect the observer to be positioned "off-centre" in the sphere of light around him (he will catch up on some of the light rays but leave others further behind). In actual fact the observer will always be positioned at the exact centre. See figure 2.2.

Some physicists (notably Lorentz and Fitzgerald) tried to find ways to square these results with the results that had been predicted using the old Newtonian ideas of æther, absolute space and absolute time. It was discovered that the results could be explained at the cost of some rather strange effects:

(i) objects "shrink" in length when in absolute motion

(ii) clocks "slow down" when in absolute motion.

These effects will distort measuring instruments (measuring rods, clocks) that are in motion. It can be calculated that this will ensure that for any observer it will always appear that light is moving away from them at the same velocity in all directions, *just as if they were truly at rest with respect to the æther and absolute space.* In other words, whether an observer is truly at rest or whether the observer is in motion the results will be exactly the same. Theories like this are *compensatory theories.* They are designed to preserve the notions of absolute space and time, despite the odd results about light.

One way to approach Special Relativity is to reflect on two disadvantages that compensatory theories suffer from. Firstly, according to the æther theory, there is one "privileged" frame of reference[9], which is at rest with respect to the æther and absolute space. *But how can we tell which is the privileged rest frame?* Because of the distortions of measuring instruments the same results will be obtained whether an observer is at rest or moving freely through absolute space. There seems to be no possible way to discover the one privileged frame: Einstein makes the radical move of *denying that there is one.*

Secondly, the compensatory theories offer no reason why objects should shrink when in motion, and clocks slow down. Note that this objection to the compensatory theories is *not* that if they are true we would have to accept these bizarre phenomenon. As I will explain later, Special Relativity

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[9] A frame of reference is the viewpoint that an observer at that particular point of space has. A frame is *inertial* if the observer moves freely i.e. is not subject to forces such as gravity.

also postulates that objects shrink when in motion and clocks slow down. Furthermore, these results have received experimental confirmation. The objection to the compensatory theories is rather that they *do not explain* why these phenomena should occur. Einstein's theory has the great advantage that these phenomena flow naturally from the basic premises of the theory. Since these are real phenomena that have been shown to occur, Einstein's theory receives a great deal of support in virtue of the elegant explanation it offers for them.

(iii) Other Sources of Special Relativity

Although the usual way to approach Relativity these days is (as I have done) by beginning with the Michelson-Morley experiment, it is worth noting that Einstein himself is reported as saying that he wasn't sure if he knew about the experiment when doing his first work in this area. I will briefly mention some of the considerations that probably influenced Einstein far more than the Michelson-Morley experiment.

Firstly, Einstein noticed that absolute time and space cause various anomalies with Maxwell's theory of electromagnetism. In a frame at rest in the æther, this theory is simple and elegant. When frames are in motion ugly complications arise. For example, a common school experiment is to scatter iron filings around a magnet. These filings form into a pattern reflecting the electromagnetic field surrounding the magnet. The precise field predicted by Maxwell's theory if the magnet was at rest with respect to the æther is very neat and elegant. But for a magnet moving with respect to the æther, the field will include ugly broken ends. Einstein's theory of space and time allow Maxwell's theory to take on its neat form *in any inertial frame of reference.*

Secondly, Maxwell's theory actually predicts the velocity of light: it can be derived from various equations in the theory. This means that *the velocity of light has the status of a law.* But laws should not usually vary in different frames of reference. Einstein's claim that the velocity of light is the same in all directions has the advantage of preserving this "universality" of physical law.

(iv) The Relativity of Simultaneity

The most relevant way to explore the consequences of these claims about light (that it appears to move away from observers with the same

velocity in every direction regardless of the observer's state of motion) is to examine Einstein's critique of simultaneity. Einstein introduces this idea with the famous *train argument.*

Suppose that we have two observers Bill and Kate. Bill is on a long train moving at a very high velocity (say half the speed of light: not a British Rail train). Kate is standing beside the track. Two flashes of lightning strike the front and rear ends of the train. Kate witnesses these two flashes from where she stands; Bill observes the same two flashes, but from his position on the moving train. Einstein uses this sort of set up to argue that the above claim about light will lead Bill and Kate to calculate different answers when asked if the two flashes are simultaneous. And since both their points of view are equally valid according to physics, he argues that *there is no non-relative fact in the physical world about whether the two flashes are simultaneous or not.* In other words, the simultaneity relation is relative to frames of reference.

In order to present the reasoning behind this conclusion as precisely as possible, and also in order to aid later discussion, I will now introduce the Minkowski spacetime diagram. See figure 2.3. The Minkowski diagram represents spacetime seen from a particular frame of reference. The vertical axis is the "world-line" of some freely moving observer. This axis measures the time through which the observer endures. The horizontal axis represents space (the 3 spatial dimensions are "condensed" to one, to make the diagram easier to draw). This axis is also the class of distant events that the observer judges to be simultaneous with event O. The lines at 45 degrees are light rays, and divide the diagram into two main regions. The regions at the top and bottom of the diagram are said to be at a *time-like* separation from O. The key feature of these regions is that signals slower than light can travel from O to points in the top part of the region (called the "forwards light cone"); and signals slower than light can *reach* O from the bottom part of the region (called the "backwards light cone"). The regions to either side of the light ray are said to be at a *space-like* separation from O. Neither signals slower than light, nor light itself, can either travel from O to any point in this region, or reach O from any point.

The next step is to think about how to find out what local events happen simultaneously with some given spatially distant event. Suppose I see a small flash of light in the night sky at the same time that I sneeze. If this flash of light comes from a source out in the solar system, I cannot say that the flash of light occurred simultaneously with my sneeze. This is

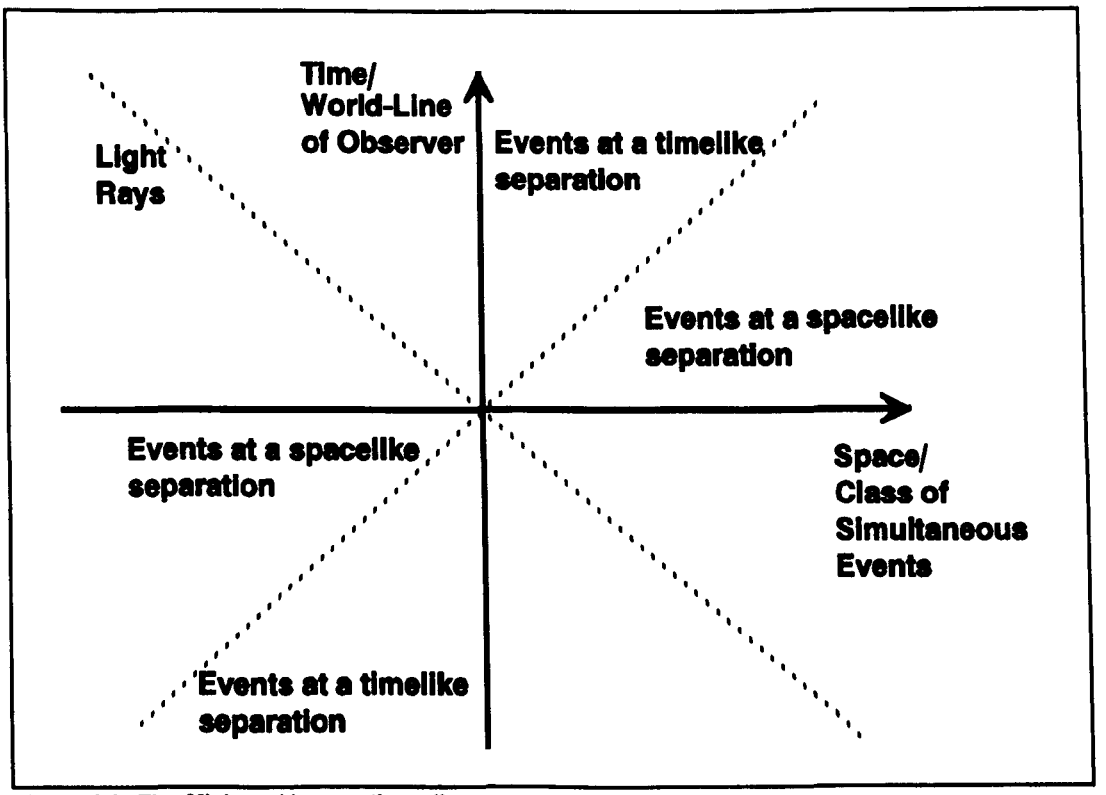

Figure 2.3 The Minkowski spacetime diagram

because the light will have taken a certain amount of time to reach me from its source.

Now, if I knew exactly how far away the source was I could presumably calculate how long ago it occurred. If the flash occurred two minutes ago I can deduce that it happened simultaneously with the local events that were occurring two minutes ago e.g. perhaps I was coughing. But there is a problem with this method. I do not have a ruler long enough to stretch from my position to the place where the flash occurred. The way I would work out how far away the flash was would be to use the speed of light. If I know how long light takes to travel from my position to the source of the flash, then given that I know the speed of light I can work out how much distance has been covered. *But in order to know how long the light takes I will first need to know what events around the source are simultaneous with the local events around me.* I will have to know what distant events are simultaneous with me when I transmit a light ray, and which distant events are simultaneous with me when the light ray arrives. But this is moving in a circle.

To avoid difficulties of this sort[10], there is an easier method for determining whether two spatially distant events are simultaneous or not. If

[10] I have simplified things considerably at this point in the discussion. For a clear and full discussion of why we have to rely on round-trips of light rays to determine distant simultaneity, see Van Fraassen, pp.151-156.

an observer at point P wants to determine which events occurring at point Q are simultaneous with event O, he should send a light ray to Q which will be reflected back to P again. See figure 2.4. Since the velocity of light is the same in all directions, event F (the light ray's reflection at Q) can be calculated to be simultaneous with events in O's locality which occurred at a time *halfway between the sending of the light ray and it's being received back i.e. event E.*

By using this method repeatedly, the observer can gradually build up a picture of how the progress of events at Q corresponds to events in his own locality. That is, he can determine which distant events are simultaneous with the events going on around him.

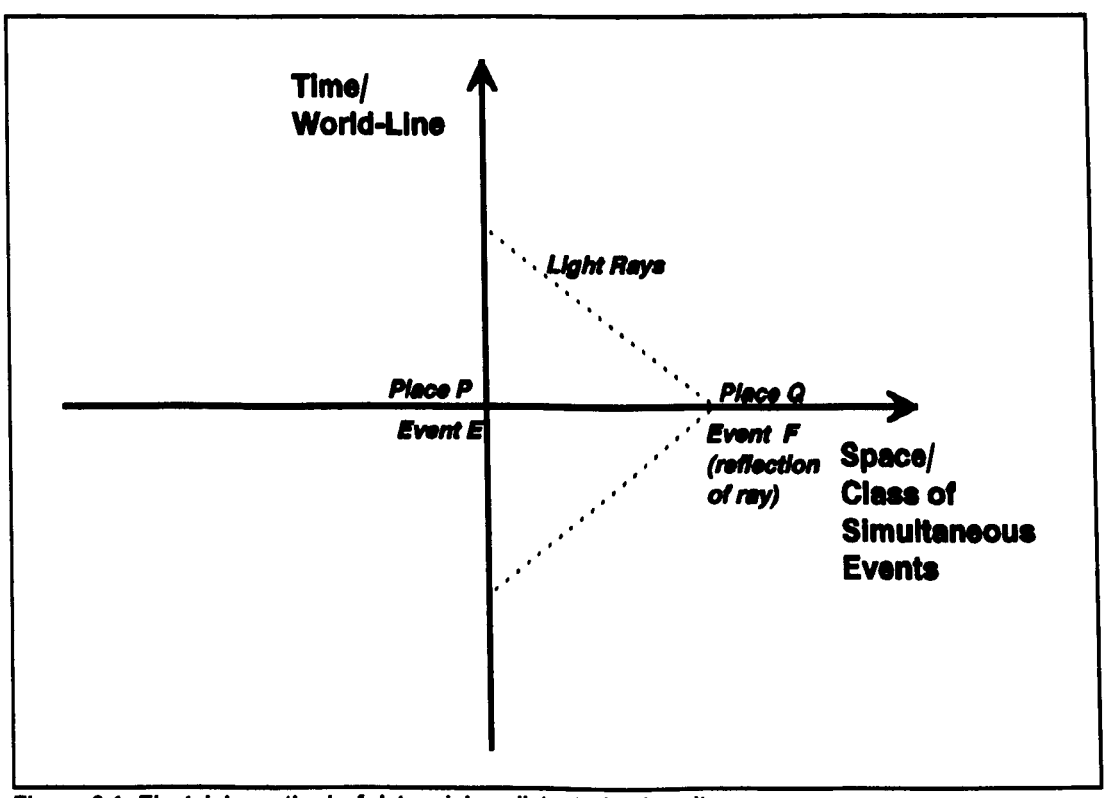

Figure 2.4 Einstein's method of determining distant simultaneity

We now have a way of working out simultaneity at a distance. Why does Einstein claim that this method will give different answers to different observers? Suppose we introduce another observer into the picture. Call the old observer Bill and the new observer Kate. Kate passes through point P, meeting Bill briefly, but then continues moving freely away from Bill at a very high speed. See figure 2.5. Drawn with respect to Bill's frame of reference, Kate's world-line (which represents her "time") lies at an angle to Bill's. This represents the fact that at later and later times Kate is further and further from

Bill. The faster the relative motion between the two observers, the greater the angle of the line.

It is important to note that Kate is moving *freely*. Because of this it is perhaps inaccurate to describe Kate as moving and Bill as stationary. Kate's viewpoint on the world is just as valid from a physical perspective as Bill's. And for Kate, it is Bill who is moving. The correct description that both Bill and Kate can agree on is that they are in motion *relative to each other.*

Suppose that both Bill and Kate want to determine which distant events are simultaneous with the event of their meeting. Call the event of their meeting, event E. Suppose Kate sends a light ray from point V towards F, which passes by Bill at W. As Kate's ray is passing Bill sends his own, and both rays head towards F. Assuming that Bill is at rest with respect to the location at which event F occurs, it follows that Kate will be in relative motion with respect to this place. Kate will in fact be getting closer and closer to the location in which F takes place. (More precisely, from Kate's point of view, this location will be getting closer to *her.*)

Now, Bill will receive his reflected light ray back from F at point Y. Since event E occurs exactly halfway between W and Y (between his sending of the light ray and his receiving it back) Bill will deduce that F is simultaneous with E. But since Kate is getting closer to F, she will receive her light ray back at X. But event E is not halfway between V and X. Therefore she will deduce that E is *not* simultaneous with F.

If we imagine that part of Kate's ray heads past F and is reflected at event F' instead, Kate will receive this part of the ray back at Z. *And event E is halfway between V and Z.* Therefore for Kate F' is simultaneous with E. Therefore although both observers use the same method, *they will get different results.* Bill will think F is simultaneous with E; Kate will think F' is simultaneous with E.

If both observer's had sent out a huge number of light rays to different events, they could use their results to discover a whole set of events simultaneous with E. This set will be different for each observer. The class of events simultaneous with E can be said to form that observer's "space". Bill's "space" is therefore different from Kate's "space". This is reflected in the diagram by the facts that Kate's space lies at an angle to Bill's.

The important point is that for Einstein both observers have an equally valid perspective from the point of view of physics. There is no physical reason to give preference to either. The conclusion is *that there is no physical basis for our usual notion of an objective, universal simultaneity.*

Instead, simultaneity varies from reference frame to reference frame. Instead of a two-place relation (*E is simultaneous with F*), simultaneity becomes a three-place relation (*E is simultaneous with F with respect to frame S*). This consequence is called the relativity of simultaneity.

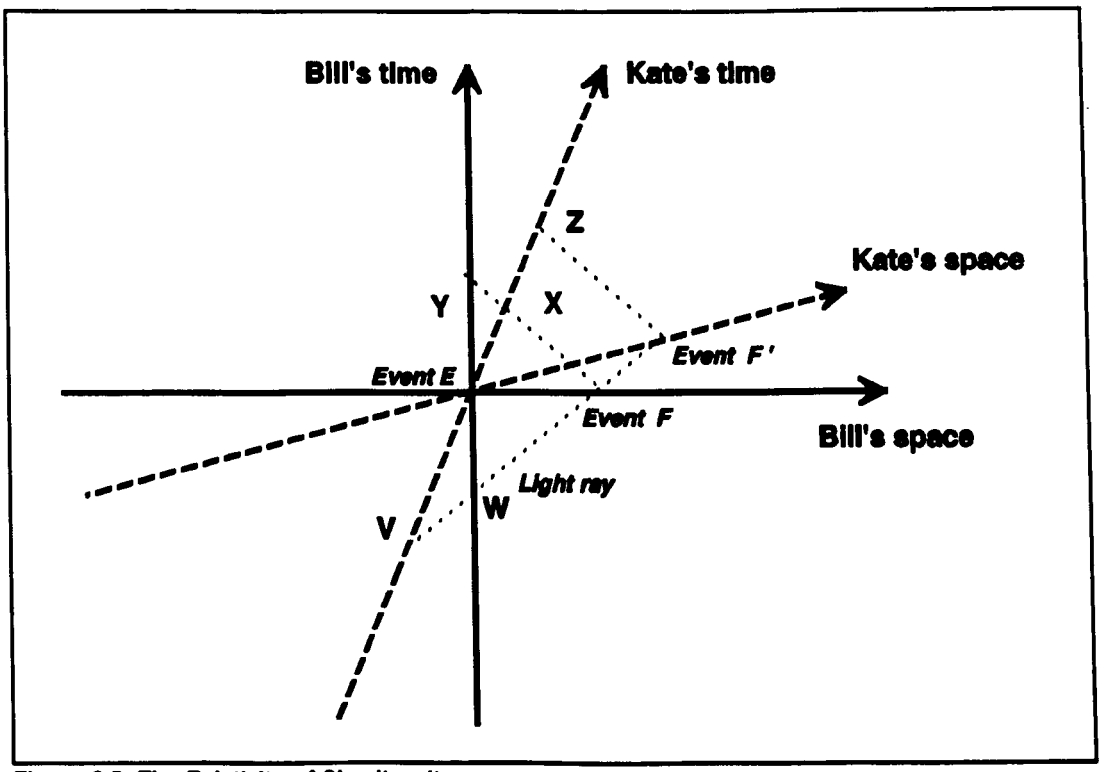

Figure 2.5 The Relativity of Simultaneity

(v) The Union of Space and Time

The relative nature of simultaneity, earlier and later can seem a bit bewildering, once it begins to sink home that there is no right answer about whether two spatially separated events are simultaneous or not. Or more precisely, that there are a large number of equally right (but different) answers. This bewilderment can be slightly mitigated by looking at some *non-relative* features of space and time.

Building on Einstein's work, Hermann Minkowski developed the concept of spacetime, a four-dimensional arena made up of the three dimensions of space and the single dimension of time. Einstein's theory can be taken as showing that different observers may divide up this four-dimensional arena into space and time in different ways. If "time" for an observer is the time as measured on their world-line, and "space" at any given moment is the class of simultaneous events, then observers moving with respect to one another will each have a different "time" and a different "space".

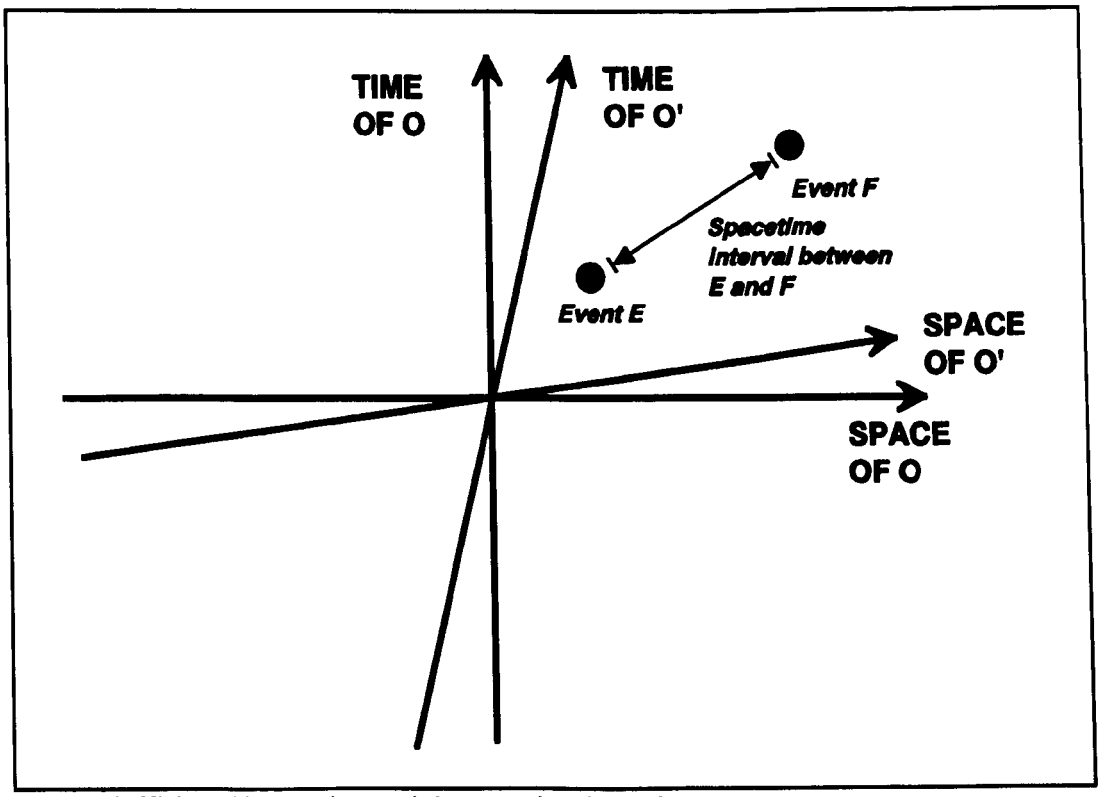

Figure 2.6 Minkowski spacetime and the spacetime interval.

Although time and space are relative in this sense, what all observers can agree on are facts about the *union* of space and time i.e. facts about Minkowski's four-dimensional *spacetime*. There are two things in particular that observers will agree on.

Firstly, given two events E and F, different observers O and O' will always agree about the *spacetime interval* between E and F. See figure 2.6. The square of the spacetime interval is the value obtained when the velocity of light times the square of the temporal interval between E and F is subtracted from the square of the spatial interval between E and F. That is, $s^2 = (d_2 - d_1)^2 - c(t_2 - t_1)^2$.

Secondly, there are some broadly temporal relations that observers can agree on. In my example with Kate and Bill, these two observers will agree about what events fall into the two main regions of the Minkowski diagram: events at timelike separation and events at spacelike separation. Although they will disagree about exactly which spacelike separated events are simultaneous, they will nevertheless agree that all spacelike separated events are what is called *topologically simultaneous*, which is defined to mean that neither Kate nor Bill could send a light signal towards these events.

The observer-independence of the spacetime interval and topological simultaneity led (amongst other factors) to Minkowski's construction of *spacetime*. Spacetime has its own structure and features, and forms an

elegant model of space and time in the context of which Einstein's theory can be understood. Minkowski apparently remarked that instead of being called "The Theory of Relativity", Einstein's work should be called "the theory of the absolute world", a positive model of space and time.

(vi) Time Dilation and Experimental Confirmation

Earlier in the chapter I mentioned how the æther theory could be saved by supposing that clocks and other measuring instruments undergo a systematic distortion when in absolute motions. These strange phenomena were cited as a problem for the compensatory theories. It may seem odd, therefore, that these phenomena are also postulated by Einstein's theory, and furthermore that they have been experimentally confirmed.

The reason why these phenomena count against the compensatory theories, however, is less the strangeness involved than the fact that the phenomena are *inexplicable*. Within the context of Newtonian ideas about absolute time and space, there is no explanation at all of why these things should happen. Lorentz tried to overcome this by developing a theory of atoms which gave some reason to suggest that objects might contract when in motion. But Lorentz's theory did not gain general acceptance. All in all, the compensatory theories were "bad" theories in the sense that the phenomena it postulated were ad hoc and inexplicable.

The situation is quite different when we come to Einstein's theory. In this case the slowing down of clocks (time dilation) and the contraction of objects are explained in terms of Einstein's basic claims about time, space and the behaviour of light. Although they are odd by our usual standards, they flow naturally out of Einstein's theory. See Van Fraassen [1], p.162-167 for a derivation of these phenomena from Einstein's basic premises.

These phenomena have also been experimentally confirmed. And since Einstein's theory predicts them (and is the only theory which makes them explicable), these experiments are taken to confirm that Special Relativity is true. These effects only become pronounced at very high velocities. At lower velocities the predicted effects are tiny and require very precise measuring systems to detect. Using today's precise instrument, there are now a wealth of confirmations of time dilation.

Using very precise atomic clocks, time dilation is now so easy to confirm that the effects can be measured when flying on a plane from America to England. BBC2 recently showed an edition of Horizon which

discussed time travel. As part of the program two famous scientists took an atomic clock with them when they crossed the Atlantic. Comparing this clock with another when they landed revealed a small difference. This difference was the exact amount predicted by Einstein's theory. To get an idea of how small the difference was, though, the program also claimed that if a person spent their whole life flying around the world with this clock, the clock would only have lost 1/10000 second in comparison with a stationary clock!

(vii) The "Relativity of the Present" Argument

The above provides enough material to examine the implications the theory has for the passage of time and to evaluate how seriously these implications should be taken. The main argument I shall discuss I call the *relativity of the present* argument.

Suppose that three observers Bill, Kate and John pass each other at P. See figure 2.7. Call the event of their meeting event E. At the moment of their meeting all of them will agree that E is present.

Using the Einsteinian method for determining simultaneity, Bill judges event F to be simultaneous with E; Kate will calculate that F' is simultaneous with E; John will calculate that F" is simultaneous with E. If we suppose that F, F' and F" are all timelike separated from each other, as in the diagram, then all three can accept that F" is earlier than F and that F is earlier than F'. So despite disagreeing on which event is simultaneous with E, all three agree on the temporal order of F, F' and F".

But this agreement on the temporal order of F, F' and F" leads to more disagreement about the temporal relations these events have with E. Since Bill calculates that E and F are simultaneous he concludes that F" is earlier than E, and F' is later than E. For Kate E is simultaneous with F': she concludes that both F and F" are earlier than E. For John E is simultaneous with F": he concludes that both F and F' are later than E.

This relativity of simultaneity, and the other relations of "earlier than" and "later than" are part and parcel of Special Relativity. Spacetime is constructed in such a way that in many cases there are no non-relative facts about these relations. This was initially quite hard for physicists to agree to, but eventually our concepts of earlier, later and simultaneous with were revised. The problem for passage is that this revision of simultaneity also has an effect on the properties of past, present and future.

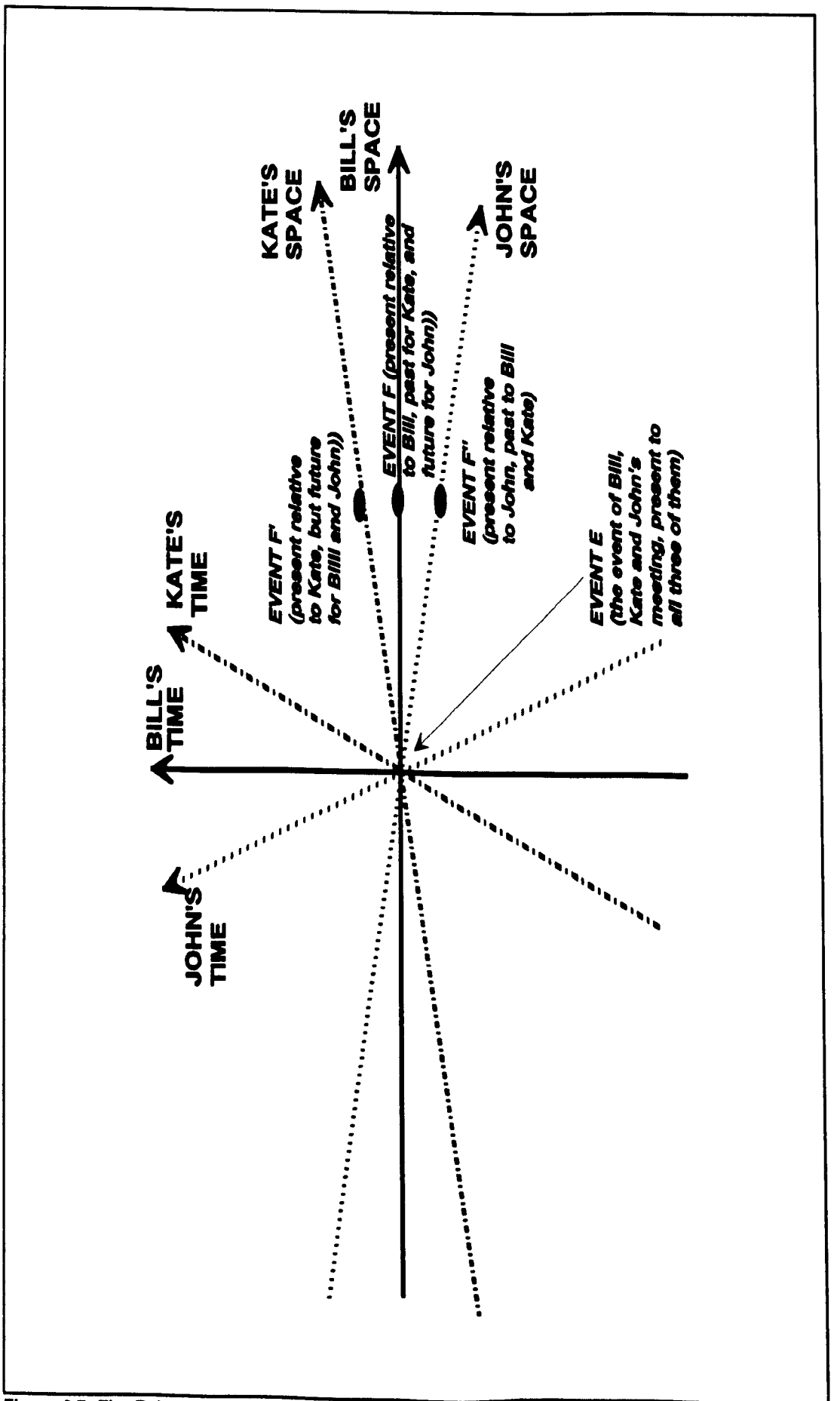

Figure 2.7 The Relativity of the Present argument

Since Bill thinks that E and F are simultaneous and also that E is present, he will think that F is present. And since he thinks that F' is later than F and F" is earlier than F, he will conclude that F' is future and F" is past. Kate will disagree. For her, F' is simultaneous with present event E, so F' is present. Since both F and F" are earlier than F', she will think that both these events are past. Finally John will judge that F" is the present event, but that both F and F' are future. In other words, Special Relativity implies that past, present and future are just as relative as simultaneous with, earlier than and later than. I summarise these disagreements in the table below:

Bill	Kate	John
F simultaneous with E F' later than E F" earlier than E	F earlier than E F' simultaneous with E F" earlier than E	F later than E F' later than E F" simultaneous with E
E and F present F' future F" past	F past E and F' present F" past	F future F' future E and F" present

But recall that neither Bill, Kate or John have a privileged viewpoint. They are all, physically, on a perfectly equal footing. Special Relativity appears to imply that *there are no non-relative facts about whether events at a spacelike*[11] *separation are past, present or future.* There seem to be much greater difficulties in relativising past, present and future, than in relativising earlier, later and simultaneous with. These A-properties are closely connected to the type of existence events have. Present events are fully real; past events are real in a slightly attenuated sense; future events are as yet only possible. It is very difficult to believe that differences of this sort could be relative to a frame of reference. For example, how can an event be present and fully real from the perspective of one observer; but future and only possible from the equally valid perspective of another observer?

[11] The problem of disagreement only arises for events at a spacelike separation. All three observers will agree on the futurity/pastness of events at a timelike separation.

(viii) First Responses to the Argument

Why exactly does this relativisation of existence seem absurd? An object can be big or small, or an event long or short, relative to different standards of comparison. But no matter how many properties are relative in this way *there must still be an object or event to have these relative properties to begin with.* Existence is not a property that things can have or not have: existence is the prerequisite of having or lacking properties at all.

Another consideration comes from noting that although the existence of some event F is relative to some observer O, this observer will himself be being observed by other (spatially distant) observers. Some of these other observers will judge that O exists, others will judge that O doesn't exist. The existence of event E is therefore made relative to an observer whose own existence is under question!

The oddity of this can be made clear by constructing a sort of vicious circle. Suppose we have two observers O, O'. Suppose O judges that O' exists but O' judges that O does not exist. How is it to be decided who really exists, if either do? O' will exist relative to an observer who, from the point of view of O', doesn't even exist!

So relativising existence does not seem acceptable. What other options are there? Firstly, it could be suggested that all events at a spacelike separation from a present event are *indeterminate* as to existence. It cannot be said of them either that they are fully real (present) or only possible (future) or anything else.

This is also hard to accept. Event E itself is assumed to be unequivocally present and real. But for many other observers, in other places, E would be at a spacelike separation. These other observers have just as valid a viewpoint as Bill, John and Kate. But for them *it is E that has an indeterminate existence.* Since every event is at a spacelike separation from some observers, the equal validity of viewpoints entails that *every event is indeterminate with respect to existence.* Even those events which seem so unequivocally present and real to us have indeterminate existence!

Another alternative would be to say that *all events* at a spacelike separation exist (tenselessly). This option has the consequence that facts about which events at a spacelike separation are past, present and future have no implications about the sort of existence these events have. If Bill judges event F' to be future he cannot also conclude that F' is only semi-real.

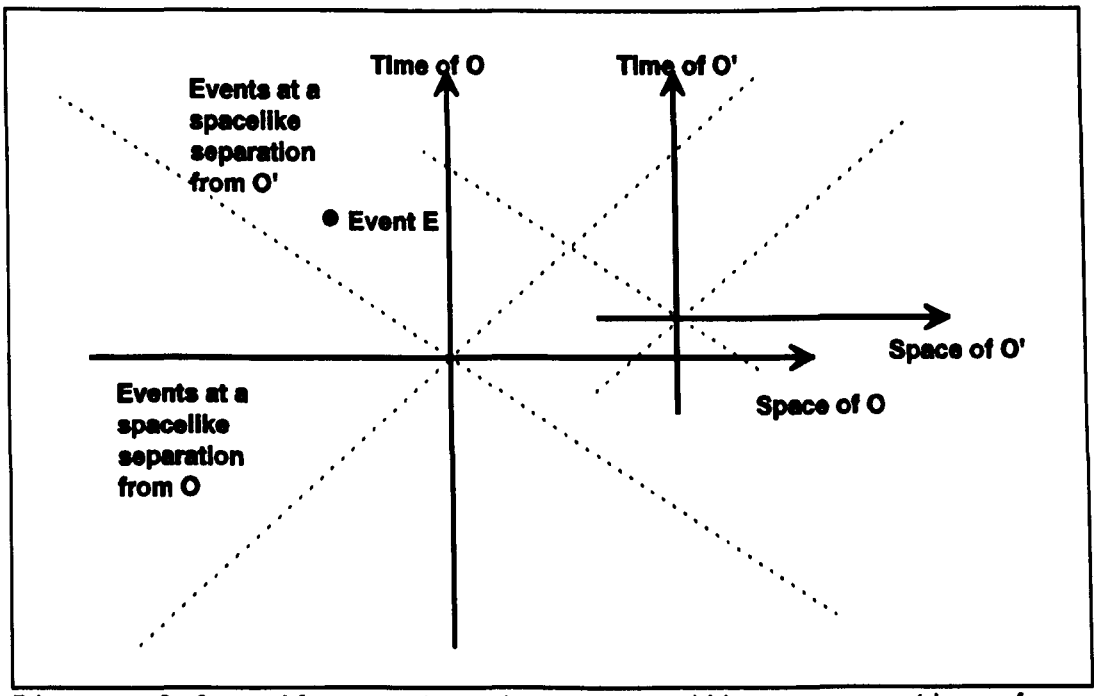

Figure 2.8. If events at a spacelike separation from O exist (tenselessly) then so do all events in spacetime

Further, once all events at a spacelike separation are granted existence, it seems that *all* events and objects must exist tenselessly. To see this consider an observer O. Suppose that the region of spacetime at a spacelike separation from O contains various events and also another observer O'. See figure 2.8. On the current suggestion, these events and also the observer O' are being said to exist tenselessly.

But there is also a spacelike region surrounding O'; and this region will include some of the events in the absolute future of O (e.g. event E in Figure 2.8). Since O' exists tenselessly and is therefore just as "real" as O, events at a spacelike separation from O' must also exist tenselessly. Thus events such as E, which are in the absolute future for O, nevertheless exist tenselessly.

This argument can be applied repeatedley, including more events each time. For example, if we imagine that there is an observer O" near event E, then this observer will exist tenselessly and so will all events at a spacelike separation from him. But this will include events in the absolute future of O'. So this tenseless existence will spread until in the end *all* events and objects in spacetime will have to be granted it. That is, all events and object in spacetime exist tenselessly. *In other words, this solution to the "relativity of the present" argument leads directly to a tenseless theory of time.*

So far these responses have accepted the basic premises of the *relativity of the present* argument. Over the next two sections I will look at two stronger responses. The first is simply to deny that Special Relativity is true, and that therefore any implications it has for passage do not matter. The second is to deny that Special Relativity is actually a theory about *time* (as opposed to a theory about light rays etc).

(ix) Is Special Relativity true?

If Special Relativity raises serious problems for passage, then given the importance of past, present and future in our ordinary ideas, it would not be unreasonable to question whether Special Relativity is true. There are perhaps two points that could be made.

The first point would be to suggest a return to some kind of "compensatory" theory. Compensatory theories are capable of "saving all the data". The advantage that they have over Relativity is that they allow a non-relative simultaneity relation. If one could find which frame was at rest with respect to the æther, one could use Einstein's light ray method to determine which class of events were non-relatively simultaneous with a given local event. Although for practical purposes we will never be able to know which class of events are *really* simultaneous (since we cannot know which frame is the required rest frame) at least we know that there *is* such a class. This is much more consistent with passage and other ideas we have about time.

Unfortunately, theories of this sort generally seem unsatisfactory. They are clumsier than Einstein's theory, and they involve unexplained phenomena. It is postulated that bodies in motion contract, that clocks in motion slow down, etc. But why should this be so? These phenomena arise naturally in Einstein's theory (they are the consequence of his analysis of space and time). But there is no reason for these phenomena to be found in any compensatory theory. This gives Special Relativity a great advantage. There are a minority of physicists today[12] who hold some sort of "compensatory" theory, and suggest ways to alleviate some of the ad hoc nature of earlier versions. Even so, there is still the uncomfortable claim that there is one true rest frame, which we can never discover. And there are the considerations that Einstein put forward to do with Maxwell's electromagnetic theory (the neatness of the theory if the velocity of light is a constant, and the fact that

[12] See Quentin Smith [1], p.246-7

the equations predict the velocity of light as a matter of law). Overall, most physicists still adhere to Einstein's theory.

Another point is that physics is in a state of deep change and discovery. It seems reasonable to ask what the accepted scientific theories in twenty or fifty years time will be like. Will the basic claims of Relativity still be acceptable? F.M. Christensen writes:

> A complete overthrow of the theories is certainly not unthinkable when we reflect on the marvellous success and ultimate rejection of Newton's theories ... Relativity and Newtonian physics agree approximately, under appropriate circumstances, in their empirical predictions, but in their basic claims about reality they are light-years apart. In science, no theory is sacred; what befell Newton's physics could well happen to Einstein's ... (Christensen [1], p.288)

There are some grounds for Christensen's claims, but there are two points, I think, which count against this answer to the *relativity of the present* argument. Firstly, Special Relativity is a well-established and experimentally confirmed theory. Although there is no telling how things will develop, the insights of Relativity into space and time are the best on offer. While keeping in mind Christensen's point it seems fair to take seriously the implications that Relativity has. As Smart writes:

> ...if we want to find out what, on our present knowledge, is the most probable view about some philosophical question ... then we should be foolish to neglect the direction in which our present scientific knowledge points ... In doing this we need not be dogmatic, for we can recognize fully that our present scientific beliefs have always to be tested against the facts, and so may have to be replaced ... (Smart [1], p.22)

Secondly, however physics develops in the future, it is unlikely that there will be a return to the simple days of Newtonian absolute time. The trend is for time to become ever more bizarre. I will shortly mention a variety of recent ideas in physics in which all manner of strange claims involving time are made. Though it is unclear what the acceptable scientific theories in fifty or so years will be, the general trend suggests that they will be no more amenable to passage.

(x) Is Special Relativity a theory about time?

Quentin Smith, among others, has argued that while Special Relativity may well be correct, it has no implications for passage, since *it does not say anything about time at all*:

> It could be argued that the STR [i.e. the Special Theory of Relativity] is false inasmuch as it purports to be a theory about time but that there is a true theory - call it the Nontemporal STR - that is just the STR except that it purports to be a theory about the observable behaviour of light rays, rigid bodies, and the like but does not purport to be a theory about time. (see Quentin Smith [1], p.229)

Smith argues his case by distinguishing between the "time" of Special Relativity (and the different sorts of "time" talked about in other areas e.g. cosmic time, mental time, Newtonian time) from a basic, underlying time which he calls *metaphysical time*. This metaphysical time is to be identified with "time itself":

> ... metaphysical time *is* time, and ... other senses in which "time" can be used are, in fact, nontemporal concepts, such as causal concepts, concepts of change, concepts of psychological experiences, and concepts of light-connectibility ... (Quentin Smith, [1], p.231)

By "metaphysical time" Smith appears to mean time in the broadest sense. Something exists in metaphysical time "if temporal predicates are required to describe any of the object's states, including such relational states as the exemplifications of relational properties of *being referred to*" (Quentin Smith [1], p.230). Thus metaphysical time encompasses not just physical objects, people, and events, but also some "entities" often regarded as timeless, like numbers and propositions. The proposition "2 + 2 = 4" exists in metaphysical time since it can be referred to, used or affirmed at different times. Metaphysical time is "all-embracing": whatever exists in "time" (in whatever sense of the word) must also exist in metaphysical time.

Another feature of Smith's metaphysical time is that it uses only primitive temporal relations: earlier, later, simultaneous with, past, present, future. Other apparently temporal terms, particularly those used in relativity, are either primitive terms or can be reduced to a combination of primitive

terms and various *non-temporal concepts* such as connectibility by light signals.

To illustrate this claim, Smith considers three senses of "simultaneity" which are often used in Special Relativity: topological simultaneity, distant simultaneity, and local simultaneity. *Topological simultaneity* is used to cover all events at a space-like separation from an observer or event. This is defined *in terms of light signals.* Two events E and F are topologically simultaneous if and only if they are unconnectible by luminal or subluminal signals. Smith's point is that topological simultaneity is primarily a non-temporal concept, despite the use of the word "simultaneity".

Secondly there is *distant simultaneity.* This is the simultaneity between spatially separate events which I discussed above. In this case E and F are simultaneous if E is at the midpoint of the observer's world-line between the emission of a light signal to F and the reception of the signal after being reflected/returned from F. This definition is phrased partly in nontemporal terms to do with the emission and reception of light signals, and partly in terms of "local" time on the observer's world-line e.g. the observer notes when the signal leaves and returns, and how much later the signal's return is. The "later" here, according to Smith, is used in the primitive metaphysical sense. Thus distant simultaneity is a mixture between non-temporal ideas about light rays, and genuine metaphysical temporal relation.

Local simultaneity means that two events are seen to occur at *approximately the same time and at the same place.* Again this definition is a mix of the temporal "at the same time" and nontemporal "approximately" and "at the same place". "At the same time" Smith regards as being the primitive metaphysical version of simultaneity.

If the above is correct, Smith takes it to mean that relativistic "time" is not really *time*, but a mixture of metaphysical time with various nontemporal ideas about light rays, etc. The relative "simultaneity" of Special Relativity (i.e. *distant simultaneity*) is not real temporal simultaneity: it is at least partly a nontemporal concept about light rays, clocks "slowing" and objects "shrinking".

True metaphysical simultaneity, according to Smith, is not a relative notion. For each time there is a non-relative, universe-wide class of (metaphysically) simultaneous events. The primitive metaphysical simultaneity relation is not subject to Einstein's critique and can retain its absolute (i.e non-relative) nature.

There are various responses that could be made to Smith, but the main question here is: can the "time" of Special Relativity be regarded as time, or is Special Relativity essentially a theory about the behaviour of light rays masquerading as a theory about space and time?

Special Relativity obviously presents itself as a theory about time. But if Smith is right it should be possible to present the key insights of Special Relativity without involving time. In other words, there will be a *nontemporal version of Special Relativity*. What would this theory be like? I can only think that it would be some form of compensatory theory. I have already argued that Einstein provides a "better" and "more elegant" theory than the idea of absolute time plus compensatory distortions in clocks and measuring rods. But compensatory theories are a possible option. If passage is essential to our view of the world then perhaps the ordinary temporal version of Special Relativity will have to go. Instead we will have to accept a compensatory theory which is about the behaviour of light rays, the behaviour of clocks and measuring rods in motion, and so on - a theory that isn't about time at all.

But even accepting this there is a further problem. Part of the undeniable empirical data that needs to be explained is that clocks *do* speed up and slow down according to their (relative) velocity. "Clocks" is used here in the widest sense. In particular, the rate at which our body processes progress is a sort of clock. In the famous "twin paradox" story, one twin goes on a high-velocity trip to the nearest star and back; the other twin stays home on Earth. When the travelling twin comes back he finds that his twin is a lot older than he is himself. This story illustrates that the slowing down of clocks and other processes at high velocities are *real effects* - not simply an artificial product of numbers and theory.

Time is generally agreed to be closely linked to change (so closely that many people have found the idea of "empty time", or time during which nothing whatsoever happens at all, very difficult). It is by repetitive processes which occur in atomic clocks, ordinary clocks, and in our own biological set up, that we measure time and are aware of its passage. For all practical purposes, "time" for the twin travelling at close to the speed of light *does* slow down: his biological and mental processes, the clocks on board his ship, run slowly in comparison with the earthbound twin. But Smith's metaphysical time is insensitive to this. Since metaphysical time is held to apply universally, it is remote from ordinary changes of this sort.

When we come to decide whether Special Relativity is about time or not, the key reflection is that Special Relativity deals with real changes. If

change and time are intimately connected, then surely Special Relativity *is* about time. Otherwise we must postulate a time that is unconnected with the changes that take place within it.

A vivid way to make this point is to reflect that if *everything* in the universe doubled its pace, this change would go unnoticed. We would not suddenly start seeing things happening quickly all around us, since our own mental processes would also quicken up. There will be no observable differences at all whether processes in the universe double their pace, increase their pace a thousand times, or slow almost to a stop. Yet Smith's metaphysical time would keep running on at its own pace. Metaphysical time is therefore completely divorced from the flow and progress of events.

There are two reasons, then, why Smith's answer to the relativity of the present argument is unsatisfactory. Firstly, his nontemporal version of Special Relativity would have to be some sort of compensatory theory. And secondly, time would have to be disconnected from the real changes that take place within it.

(xi) The Inflexibility Argument

The main point I want to bring out in this section is that traditional models of passage of the sort described at the start of this thesis find it hard to accommodate many new ideas in physics. This "inflexibility" of traditional views of passage is not a knock-down argument. But it does suggest the need for more open-mindedness.

In an interesting paper discussing time travel, Jack Meiland suggests a bizarre two-dimensional model of time. As justification for putting forward this model he suggests that if we kept coming across time travellers, we would have reason to alter our concept of time. If Dr.Who really kept appearing in the back garden with tales of different centuries, our commonsense ideas about time would have to be upgraded or replaced. Meiland writes:

> ... it is one legitimate function of the metaphysician to invent alternative concepts which we might someday wish to employ ... our old, linear, and one-dimensional theory of time was developed to handle a rather limited set of phenomena. If new phenomena of the sort just described [the arrival of strange futuristic machines and people] were to occur, we might well want to discard the old, limited concept and replace it with a more inclusive and flexible concept. (Meiland [1], p.161)

I think that the general point Meiland is making is valid. In the last few hundred years physics has come a long way. In this century in particular, many ideas in physics are increasingly ill at ease with a standard passage metaphysics. Even without Meiland's time travellers, there are many real phenomena in the universe which would fit better with either refined ideas about passage, or even a complete rejection. From the point of view of physics, a more flexible, less obscure, and less metaphysically laden model of time would be far more suitable than a traditional passage model.

I list below some examples of recent ideas in physics that sit uneasily with passage. Details of these ideas, should the reader be interested, together with brief expositions of the theories involved, can be found in Appendix A.

(a) Closed Time (General Relativity). On one solution of the equations of General Relativity, time is closed like a circle. In other words, *travelling far enough into the future will bring one back to the distant past.* The rigid distinction between past and future breaks down here, since all events are both earlier and later than all other events.

(b) Wormholes (General Relativity). General Relativity permits spacetime to form wormholes, shortcuts from one point of spacetime to another. If a wormhole connects two different points of time, both these times *must be real*, even if one is future or past.

(c) Wave collapse (Quantum Theory). On one interpretation of Quantum Theory, only a conscious observer can cause a wave function to collapse. If some events in the early universe have never been observed, there will be uncollasped wave functions stretching back millions of years. *An observation made now could therefore play a role in determining what happened in the distant past.* But on a traditional passage view the past is fixed and cannot now be affected.

(d) EPR experiments (Quantum Theory). The EPR experiments devised by Einstein, Podolsky and Rosen appear to mean that quantum theory involves "action at a distance". A measurement made by an observer at one point of space can *instantaneously* affect events at a distant point of space. This is in conflict with Special Relativity. *One solution is to accept that causal signals can run both forwards and backwards in time.* This is unacceptable on a traditional passage model: backwards causation implies that present causes can affect the "unalterable" past; and the as yet unreal future can have a causal influence of things happening now.

(e) Wheeler-Feynman absorber theory. This theory about radiation postulates that particles emit radiation both forwards and backwards in time, again unacceptable on a passage model.

(f) Feynman's theory about positrons. Feynman suggests that positrons are really electrons *moving backwards in time.* But if the future is still unreal, how can a particle that is now present have *come from* the future?

Although these ideas are from the speculative side of physics, I think that they should still be taken as possibly true. The mere possibility of any of these ideas being true is a warning against ruling them out of court by appealing to metaphysical ideas about time and passage. However, I will not pursue the inflexibility argument any further here.

(xii) Conclusions

The main argument in this chapter was the *relativity of the present* argument. This argument seemed to raise serious difficulties for passage. Properties like pastness, presentness and futureness do not lend themselves to being relativised to frames of reference, since they have implications for the reality of events and objects. If it is not acceptable to relativise reality then there seem to be three options:

(i) Accept Quentin Smith's argument that Special Relativity is not about time, but in fact about light rays etc. The value of this approach is that, if it works, the findings of Special Relativity could be preserved, but the troublesome implications removed.

(ii) Deny, as Christensen suggested, that Special Relativity is true.

(iii) Give up the idea that the pastness, presentness or futureness of an event in any way affects that event's existence/degree of reality (or affects the event in any way at all which cannot be relativised to a frame of reference).

I have already argued against the first two of these options: Special Relativity *does* make claims about time; and we have good reason to believe that it is true (or at least that no theory more conducive to passage is likely to replace it).

The problem with taking the third option is that an essential feature of passage is that pastness, presentness and futureness have implications about reality or existence (or at the very least intrinsic, non-relative properties). *But this is just what this third option denies.* In other words, taking the third option amounts to rejecting passage.

The *relativity of the present* argument therefore gives a strong reason to doubt the reality of passage, at least as passage is traditionally conceived. As I said at the end of Chapter One it is possible that an alternative conception of passage might have the resources to respond to this argument. The conclusion of this chapter - that we have found a strong argument against passage - is therefore provisional and I will review it at the end of Chapter Four.

Chapter Three

The Unreality of Time

(i) Introduction

In this chapter I will look at probably the most well-known argument against passage: McTaggart's Paradox. First McTaggart argues that the A-Series is essential to the nature of time, since only the A-Series can account for the change we find all around us. But secondly, he argues that the A-Series is contradictory and cannot exist. It is this second part of the argument that I am interested in here. At the end of the chapter I will also look briefly at an argument recently put forward by Timothy Sprigge. Sprigge reaches the same conclusion as McTaggart by a different route. Like McTaggart, Sprigge thinks that the A-Series is essential to time. Also like McTaggart, but for different reasons, he does not think there is really an A-Series. Hence time must be unreal.

The basic points put forward by McTaggart are quite simple. But the argument as a whole can be quite frustrating: sometimes it seems completely sophistical, but at other times it seems to show up a deep contradiction in the ideas of passage and tense. Many different ways of formulating the argument have been put forward. Mellor expresses the core idea as follows:

> Many A-Series locations are incompatible with each other. An event which is *yesterday*, for example, cannot also be *tomorrow*. Past, present, and future tenses are mutually incompatible properties of things and events. But because they are forever changing, everything has to have them all. Everything occupies every A-Series location, from the remotest future, through to the present, to the remotest past. But nothing can really have incompatible properties, so nothing in reality has tenses. The A-Series is a myth (Mellor [1], p.92)

In order to understand the force of McTaggart's argument it may help to say something about change and the way time is used to prevent change from leading to contradictions. I will look at this before presenting the paradox.

(ii) Change and Contradiction

To take a mundane example of change: suppose I am decorating and I paint one wall (originally a nice apple white) in a shocking shade of pink. In this case of change there are two incompatible states of affairs:

(1) The wall is white all over
(2) The wall is pink all over

In a sense all change involves a contradiction. How can the very same wall be both white all over *and* pink all over? In practice this risk of contradiction is easily avoided. This is because we always use *time* to keep the two states of affairs separate - a wall can be white all over and pink all over simply by being white all over and pink all over *at the different times*.

Time can be used to avoid contradiction in two distinct ways, one related to tensed time and one to tenseless time. The key is to focus on the use of "is" in (1) and (2). If it is tensed then it means "is now". So (1) and (2) can be restated as:

(3) The wall is **now** white all over
(4) The wall is **now** pink all over

Contradiction is avoided by realising that (3) and (4) are never both true at the same time. After I have painted the wall the true situation is:

(5) The wall **was** white all over
(6) The wall **is now** pink all over

If "is" is tenseless (i.e. used in the sense in which two and two *is* four), then (1) and (2) become:

(7) The wall **is (tenselessly)** white all over
(8) The wall **is (tenselessly)** pink all over

Any possible contradiction here is avoided by realising that (7) and (8) are incomplete: the statements need to be qualified by adding dates. For example:

(9) The wall is (tenselessly) white all over **on Sunday**
(10) The wall is (tenselessly) pink all over **on Monday**

Or more generally:

(11) The wall is (tenselessly) white all over at t(x)
(12) The wall is (tenselessly) pink all over at t(y)

In general, time is needed in one of these two ways whenever there is change. When something changes - from large to small, from wet to dry, from hot to cold - there will always be two incompatible situations needing to be kept separate. Time, whether via the tensed approach or the tenseless approach, ensures that there is no contradiction.

(iii) McTaggart's Paradox: A Presentation

On the tensed view of time events[13] undergo change from being-future to being-present to being-past. This means that in the life of an event *e* there are three incompatible states of affairs:

(13) Event *e* is past
(14) Event *e* is present
(15) Event *e* is future

As in the case of the white/pink wall there is a contradiction here. How can the very same event be future *and* present *and* past? But again the contradiction seems sophistical and easily avoided: clearly event *e* doesn't have all these properties at the same time.

Suppose that the "is" is tensed. Then the three incompatible states of affairs are:

(16) Event *e* **is now** past
(17) Event *e* **is now** present
(18) Event *e* **is now** future

[13] Moments of time also undergo this change. Although I apply McTaggart's paradox to events, the same points apply equally to times.

Any contradiction here is apparently resolved by noting that these three states of affairs never obtain all at once. If *e* is now present, it follows that *e* was future and will be past. So we have:

(19) Event *e* **will be** past
(20) Event *e* **is now** present
(21) Event *e* **was** future

But McTaggart's response is that this hasn't solved the problem: it has only pushed it one step further back. To say that event *e* will be past or was past is to attribute to *e* a more complex sort of properties. *E* will be past unpacks as "*e* is past at some future moment of time" or more formally "*e* is past in the future". *E* was future similarly unpacks into "*e* is future in the past".

Call the three basic properties "future", "present", and "past" ***first-order A-Series properties*** and the more complex properties like "future in the past" ***second-order A-Series properties***. McTaggart claims that contradiction arises just as much on the second-order level as on the first. There are *nine* second-order A-Series properties:

past in the past
past in the present
past in the future
present in the past
present in the present
present in the future
future in the past
future in the present
future in the future

Because of passage, every event will have all of these properties. But some are incompatible, so again there is a contradiction. For example, *e* will have the following three incompatible properties:

(22) Event *e* is past, in the present
(23) Event *e* is present, in the present
(24) Event *e* is future, in the present

As before, the "is" could be the tensed "is now". Someone could say that events do not have all these second-order properties at once. Although it is contradictory for event *e* to be both *past in the present* and *present in the*

present, it might be that *e* is **now** present in the present, and **will be** past in the present. This unpacks into:

(25) Event *e* is past in the present, in the future
(26) Event *e* is present in the present, in the present

But the contradiction will only repeat itself at the higher level of **third-order A-Series properties**. For example, *e* will be both *present in the present in the present* and *past in the present in the present*. These two properties are incompatible. The next move will have to be to invoke **fourth-order A-Series properties**. It is possible to go on and on in this way, resolving the contradiction at one level by moving to a higher level which suffers from exactly the same contradiction. In Mellor's words:

> There is ... an endless regress of ripostes and rebuttals, a regress that is vicious because at no stage in it can all the supposed tensed facts be consistently stated (Mellor [1], p. 94)

Since trying to resolve the contradiction in a tensed way leads to this "vicious infinite regress", suppose we understand the "is" tenselessly instead. The contradiction is then that *e* is all three of tenselessly past, tenselessly present, and tenselessly future. This is easily resolved by adding on times:

(27) Event *e* is (tenselessly) past at time t_3
(28) Event *e* is (tenselessly) present at time t_2
(29) Event *e* is (tenselessly) future at time t_1

This avoids contradiction, but the problem for someone who believes in passage was seen in Chapter One. This answer relativises A-Series properties to B-Series times, destroying the essential character of the A-Series. Firstly, it means that no event is intrinsically past, present or future. An event is not past, present or future *simpliciter* but only relative to a B-Series time. Secondly, no event "changes" these properties. If it is true that event *e* is tenselessly past at t_3 then it is always true. In this way both the intrinsic differences and dynamism associated with passage are removed from our conception of time. Contradiction is avoided, but at the cost of rejecting the A-Series.

This is the dilemma presented by McTaggart's paradox. Either we take the first option and end up with nothing but contradiction. Or we take the

second option and remove the most distinctive and vital features of the A-Series.

(iv) A Brief Formal Presentation

It will be useful to present a formal version of McTaggart's paradox. The symbolism introduced here will also help make the rest of this chapter clearer and more succinct. The formal proof uses three basic *tense operators*:

P stands for "it was the case that"
N stands for "it is now the case that"
F stands for "it will be the case that"

So for example, "**P***e*" stands for "it was the case that *e*" (*e* is past). These operators can be applied repeatedly, so that we can have constructions like "**FP***e*". This is to be read as "it will be the case that it was the case that *e*" (*e* will be past, or *e* is past in the future).

Using these operators McTaggart's Paradox can be written as follows:

(1) **P***e* → ¬ **N***e*; **P***e* → ¬ **F***e*
N*e* → ¬ **P***e*; **N***e* → ¬ **F***e*
F*e* → ¬ **P***e*; **F***e* → ¬ **N***e*

(pastness, presentness, futureness are incompatible properties)

(2) **P***e* & **N***e* & **F***e*

(due to passage, events have all three properties)

Note that (2) can be interpreted in either a tensed or tenseless way. If **P***e* is tensed it means "it is now the case that *e* is present"; if it is tenseless it means "it is tenselessly the case that *e* is present". There are therefore two routes available to escape from the contradiction of combining (1) and (2). Taking the tensed route (2) can be modified to:

(2)' **FP***e* & **NN***e* & **PF***e*

(*e* will be past, is now present and was future)

But (2)' runs into trouble because we have (for example):

(3) **NP***e* → ¬ **NN***e*; **NP***e* → ¬ **NF***e*

(4) **NP***e* & **NN***e* & **NF***e*

(3) and (4) together again yield a contradiction.

The tenseless option is to modify (2) to:

(2)" **P***e* at t3 & **N***e* at t2 & **F***e* at t1

(*e* has its A-Series properties relative to different B-Series times)

But this approach essentially destroys the unique features of the A-Series

(v) An Indexical Version of McTaggart's Paradox

The above presentation of McTaggart's Paradox is fairly orthodox. But the paradox has been put in many different ways. Michael Dummett, for example, has restated and defended it by stressing the indexical[14] side of terms like "present", and "past". Instead of saying that all events are past, present and future, Dummett points out that all events are both "now" and "then". From one point of view it is raining "now"; from another point of view it was raining "then". But no event can be both "now" and "then" at the same time. At first sight this is just a pseudo-problem: of course an event isn't "now" and "then" at the same time. But the real problems come when we try to state this obvious answer more clearly.

The tensed option is to say that it is raining now *now*, but it is raining then *then*. In other words, we answer the questions *when is it raining "now"?* and *when is it raining "then"?* by saying that it is raining now, now (at this very moment) and that it is raining then, then (at some other moment of time). So the contradiction is avoided since the rain is not both now and then, but only *now now* and *then then*. The problem is of course that an event which is *now now* or *then then* will at some point also be *then now* and *now then*.

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[14] Common indexicals are "I", "you", "here", "there", "now", and "then". These words are indexicals because which person, place or time that they pick out varies according to *who* uses the words, *where* they are said, and *when* they are said. Sentences containing indexicals like "I am hungry", "The church is over there", "The bus is here now" have varying truth-values. If I say "I am hungry" I may be telling the truth; but if you say the same words you may be lying.

And since time passes we will have a second-level contradiction of an event being all of *now now*, *then then*, *now then*, and *then now*.

This leads to the same sort of infinite regress found in the standard version of McTaggart's Paradox. The next step is to argue that e is not both *now now* and *now then* (which is contradictory) but is *now now now* and *now then then*. Apart from being increasingly confusing and silly, this step suffers from the same sort of contradictions as before. Events will not only be *now now now* but also *now now then* and so on.

The tenseless option is to say that for each event *e*, *e* is "now" at t(x) and "then" at t(y). If it rains at 3 p.m. it will be true to say that it is raining "now" at 3 p.m.; at 4 p.m. it will be true to say that it was raining "then" (referring to 3 p.m.). But this means that the A-Series is relativised to B-Series times and loses its most essential features. Firstly, there would no longer be anything special about an event being "now", since all events are "now" at the appropriate time. The raining is "now" at 3 p.m.; the sun's shining is "now" at 4 p.m., and so on. Secondly, there is no longer any genuine passage. If the rain is (tenselessly) "now" at 3 p.m. then it is always the case that the rain is "now" at 3 p.m. This fact will never change.

(vi) Lowe and the Indexical Fallacy

I have mentioned Dummett's indexical version of McTaggart's Paradox in order to help understand the most sustained discussion of the paradox in recent years. This discussion was between E.J. Lowe on one hand and Hugh Mellor and Robin Le Poidevin on the other.

Although what Lowe has to say applies most clearly to Dummett's version of the paradox, Lowe claims that the same point applies to more orthodox versions (like my own presentation at the start of the chapter). This is because words like "past", "present" and "future" have a strong indexical element, almost to the same degree as "now" and "then". What events and times the words "past" or "present" or "future" pick out varies according to *when* these words are used. What Socrates called past, present and future is different to what we today would call past, present and future.

To begin with Dummett's version of the paradox, the argument leading to a vicious infinite regress rests upon phrases like *e is now then* (or *then now* or *now then now*). Lowe claims that these phrases are illegitimate: they commit what he calls the **indexical fallacy** (see Lowe [1]).

Whenever a person *uses* words like "I", "here", and "now", the meaning these words have is constrained by *who* the person is, *where* they are and *when* they are. If Tom, standing in Oxford Street in 1995, says "I am here now", then the "I" picks out Tom, "here" picks out Oxford Street, and "now" picks out 1995.

Because of this standard use, it is more or less senseless to use expressions like *I to you* or *here there* or *now then*. It is true that from my perspective I am "I", and that from your perspective I am "you". But when I try to express this by saying that I am *you to you* or that you are *I to you*, I am talking nonsense. Used by me "I" means myself, and "you" means the person I am talking about. For example if Peter says to Paul "you are I to you" he is constrained by circumstances to mean "Paul is Peter to Paul", which is nonsense. The same applies in the case of time:

> when I use the expression 'present', or 'now', I can no more use it to refer to another temporal perspective than I can use 'I' to refer to another person. This is because what *I* can use such indexical expressions to refer to is not just up to me, but is constrained by my circumstances ... (Lowe [1], p.67)

So if I say in 1996 "399 B.C. is now then", I am (in Lowe's view) constrained by circumstances to mean something like "399 B.C. is at 1995 A.D. in 399 B.C."!

Similar points apply to more standard versions of McTaggart's Paradox. "Past", "present" and "future" are indexical in the same way as "now", since what times and events these words denote are different each time they are used. According to the proper use of indexicals, if I say in 1996 "399 B.C. is present in the past", I am saying something like "399 B.C. is at 1995 A.D. at some time earlier than 1995 A.D.". This just seems silly.

The point is that using expressions like *now then* or *present in the past* results in nonsense. The indexical fallacy is more obvious the further down McTaggart's vicious infinite regress one goes. But it occurs even at the first stage. The tensed interpretation of **P***e* & **N***e* & **F***e* commits the fallacy, since to assert "**F***e*" is to say "e is now future". This is little different from saying that *e* is *now then* (i.e "now" at some future time). If one of the key premises in McTaggart's argument contains a misuse of language it is not surprising if the conclusions are bizarre (e.g. that time is unreal).

(vii) What Does the Indexical Fallacy Show?

The indexical fallacy seems to be a strong criticism of McTaggart's Paradox. McTaggart's Paradox, as stated, does not work. But curiously enough, there is a broader sense in which *the indexical fallacy actually supports McTaggart.* I will try to explain what I mean in the following few paragraphs.

The structure of McTaggart's Paradox is as follows. Firstly, there is a supposedly contradictory premise of the form **P***e* & **N***e* & **F***e*. When the premise is looked at more closely we realise that there are two ways of

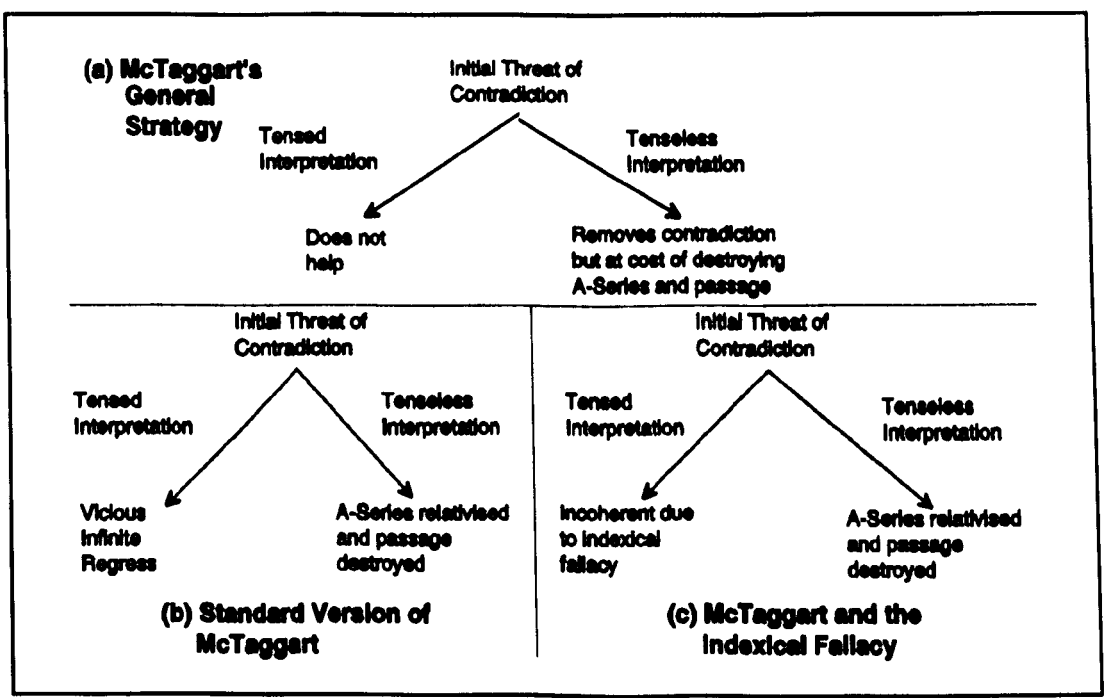

Figure 4.2. McTaggart's general strategy

understanding it. "F*e*" (and similarly for P*e* and N*e*) means "*e* is future". But this could mean either "*e* is now future" or "*e* is tenselessly future". This ambiguity in the initial claim then leads to two distinct lines of reasoning. Firstly, it is claimed that understanding and resolving this contradiction in one way (the tensed A-Series way) leads to an infinite vicious regress. Secondly, it is claimed that understanding and resolving the contradiction in another way (the tenseless B-Series way) effectively destroys genuine passage and tense. See figure 3.2 (b) (bottom left hand corner).

Put even more generally the argument is that there are two ways to resolve the contradictory premise **P***e* & **N***e* & **F***e*. The tensed way does not work. The tenseless way destroys passage. See figure 3.2 (a).

Lowe's indexical fallacy supports general strategy. The tensed interpretation still does not work: the difference is that this is due to an absurd use of indexicals rather than an inability to escape contradiction. In other words the tensed option is hardly an option at all: the only way to interpret "*e* is past and *e* is present and *e* is future" in a tensed way immediately commits the indexical fallacy. Because of this we are forced to take the tenseless option as the only coherent interpretation available. So while the indexical fallacy shows that the details of McTaggart's Paradox are flawed, on a more general level the fallacy *reinforces the basic point being made*. See figure 4.2 (c).

(viii) An Alternative Analysis

To avoid the paradox while still preserving passage requires some alternative way of understanding the tensed option. This is just what Lowe offers later in his paper. He points out that there is of course *some element of truth* behind the claim (however absurdly phrased) that a time is now future or *now then*. For Lowe the best way to capture this is to say that "it will be [or was] possible to express a true statement by means of the sentence 'e is present', or 'e is happening now'..." (see Lowe [1], p.66). Rather that saying that a past rainstorm is *now then* or *present in the past*, it is better to say that the sentence "it is now raining" *would have expressed something true if it had been used then.*

Using this analysis, then, "*e* is present" means that it is now possible to express a truth using the sentence "*e* is now present; "*e* is future" or "*e* will be present" means that it *will be* possible to express a truth using the sentence "*e* is now present"; "*e* is past" or "*e* was present" means that it *was* possible to express a truth using the sentence "*e* is now present". This gives an alternative way of understanding the initial premise **P***e* & **N***e* & **F***e*.

But while this may be a coherent alternative, it is arguable that it still falls foul of McTaggart's Paradox. This is the view taken by Mellor and Le Poidevin (see Le Poidevin [3]). What follows is a slightly altered version of the way they apply the paradox to Lowe. The first step is to introduce some symbolism:

N*e* (meaning as before that *e* is present)

NT'**N***e*' (meaning that it is now true - **NT** - to say that *e* is present - '**N***e*')

PT(**FT**'**N***e*') (meaning that it was true - **PT** - to say that it will be true - '**FT**' - to say that *e* is present - "**N***e*"

Note to begin with that there is an initial contradiction between saying that it is now true to say that *e* is present, and saying that it was true or will be true. Since *e* is only present fleetingly it cannot both be true now to say that it is present and going to be true that it is present. Put symbolically the initial contradictory premise is:

FT'**N***e*' & **NT**'**N***e*' & **PT**'**N***e*'

The contradiction could be avoided by saying that it is *now true* to say that 'it is now true to say that "*e* is present"' and it *will be true* to say that 'it was true that "*e* is present"'. Symbolically this is:

NT(**NT**'**N***e*') & **FT**(**PT**'**N***e*')

But this removes the contradiction at one level only to replace it with a contradiction at a higher level. On this higher level there is a contradiction between (for example):

NT(**NT**'**N***e*') & **NT**(**NF**'**N***e*')

This series of escapes and higher-order contradictions are clearly the first steps along McTaggart's infinite vicious regress. This means that the only way to resolve the contradiction is to go back to looking at things tenselessly:

'**N***e*' is true if said at t_1
'**N***e*' is false if said at any time t that is not t_1

But this has the effect of taking away the most essential features of passage: it is tenselessly true to say of *any event* that it is present, so long as this claim is made at the right time; and this truth *never changes*.

This restatement of McTaggart's Paradox appears to avoid the indexical fallacy. The key phrases are not illegitimate ones like "now future", but phrases like "now true" and "now false". But Lowe is still not happy. In a later paper (see Lowe [2]) Lowe replies saying that the indexical fallacy was not his whole answer to McTaggart but only part of an overall strategy to reduce the force of the argument.

Lowe now raises another problem with the paradox. Lowe argues that the initial premise should not be the contradictory *conjunction* of terms **P***e* & **N***e* & **F***e*, but a non-contradictory *conjunction of disjunctions*:

> Rather than say that every event is past and present and future, we should properly say that every event is such that it both was or is or will be truly describable as "past", and was or is or will be truly describable as "present", and was or is or will be truly describable as "future" ... (see Lowe [2], p.325)

Symbolically this is:

> (**NT**"**N***e*" or **PT**"**N***e*" or **FT**"**N***e*") & (**NT**"**P***e*" or **PT**"**P***e*" or **FT**"**P***e*") & (**NT**"**F***e*" or **PT**"**F***e*" or **FT**"**F***e*")

And this seems quite sensible. We don't ever think both that "it is now Elizabeth's Golden Jubilee" is now true and that "it is now Elizabeth's Golden Jubilee" was true (i.e. **NT**"**N***e*" & **NT**"**P***e*"). Either one or the other is true; never both.

If the above is correct then there is no contradiction to be explained to begin with. Since it is never the case that it is true to say either that *e* is past or *e* is future, and at the same time true to say that *e* is present, there is never any need to follow the path to either McTaggart's regress or the tenseless destruction of passage.

(ix) Is There An Initial Contradiction?

The question this raises is whether the initial premise should be the contradictory:

(A) $\mathbf{FT}$'N*e*' & $\mathbf{NT}$'N*e*' & $\mathbf{PT}$'N*e*'

Or whether it should be the non-contradictory premise:

(B) ($\mathbf{NT}$"N*e*" or $\mathbf{PT}$"N*e*" or $\mathbf{FT}$"N*e*") & ($\mathbf{NT}$"P*e*" or $\mathbf{PT}$"P*e*" or $\mathbf{FT}$"P*e*") & ($\mathbf{NT}$"F*e*" or $\mathbf{PT}$"F*e*" or $\mathbf{FT}$"F*e*")

Which of these premises (A) or (B) is the correct one? (B) is clearly preferable in so far as no contradiction is involved. But it has been argued by Le Poidevin (see Le Poidevin [4]) that in so far as (B) is a statement about passage - an attempt to express the core element of truth behind phrases like "*e* will be past" - then something essential has been left out. To capture this "something" requires the contradictory premise (A).

To show this, Le Poidevin argues that a close parallel of (B) is also true of space. We can say that:

(C) ($\mathbf{HT}$"H*e*" or $\mathbf{OT}$"H*e*") & ($\mathbf{HT}$"O*e*" or $\mathbf{OT}$"O*e*")

In this sentence, **HT** stands for "it is true to say *here* that" and **OT** stands for "it is true to say over there that"; H*e* stands for "*e* is here" and O*e* stands for "*e* is over there". So (C) means: "Either it is true to say *here* that '*e* is here' or it is true to say *over there* that '*e* is here'; or it is true to say *here* that '*e* is over there' or it is true to say *over there* that '*e* is over there'".

Le Poidevin's point is that this sort of construction says nothing about passage. Space does not pass. If Lowe's formulation is supposed to capture the "element of truth" behind passage, it is surely a sign that something has been left out if the same formulation can be applied to passage-less space.

The failure of (B) to express the full truth of passage does not in fact trouble Lowe. Although Lowe does not accept McTaggart's Paradox, he is certainly not a traditional tensed theorist. He does not accept either McTaggart-type passage or the moving-now model of passage[15]. But the inadequacies of (B) *do* affect these traditional metaphysical conceptions of passage.

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[15] Lowe argues that our notion of passage comes from the *ineluctability* with which we find ourselves ever at successive points of time: we have freedom to move about or stay still in space, but in time we must always move to the next successive moment. I will not discuss this idea here, although I touch on it briefly in Appendix B on "Spacelike time".

To see the problem, notice that (B) is compatible with a static picture in which events do not "change" from future to present to past. Suppose that *e* is present. It will then be the case that **NT**"N*e*", and **FT**"P*e*", and **PT**"F*e*". These three facts are quite adequate to make statement (B) true. But (B) would remain true even if it were the case **forever** that **NT**"N*e*", and **FT**"P*e*", and **PT**"F*e*" (i.e. if *e* were present forever). This change is a key feature of passage, yet nothing about (B) itself suggests the need for any change. If (B) is supposed to express the core truth about passage then this is very odd.

For this kind of reason philosophers like Mellor and Le Poidevin feel that (B) is an inadequate premise. In their opinion (A) *does* capture the passage of time, in so far as it entails both that it is now true to say that "*e* is present" *and* that is will be true to say that "*e* is present" *and* that it was true to say that "*e* is present". That is, all three states of affairs *must* (at some point) obtain.

I will argue in the following section that there is a sense in which both (A) and (B) - express part of the truth. Explaining the element of truth behind each of these statements will lead to the heart of McTaggart's argument and to an understanding of whether it works or not.

(x) The Core Problem Behind McTaggart's Paradox

To explain what I consider to be the core problem behind McTaggart's Paradox it will be necessary to take another look at ordinary change e.g. the wall which was white all over then pink all over. As I pointed out in the introduction of this chapter there is a sense in which the very same wall is *both* white all over *and* pink all over. The qualification is that the wall doesn't have these properties *at the same time*. This reveals two (slightly opposed) aspects of change. Because it is the very same wall that is (at one stage) white all over and (at another stage) pink all over, there is a sense in which it is true to say that:

(1) The wall is white all over **AND** the wall is pink all over

This aspect of change emphasizes the fact that the same constant persisting object has both properties. To emphasize the point that the wall does not have these two incompatible properties *at the same time*, we would say:

(2) The wall is white all over **OR** the wall is pink all over

(1) is true in the sense that it is the same wall which has both properties. (2) is true in the sense that the wall has these properties at different times. Both statements reflect something important about change.

These two aspects of change repeat themselves when talking about past, present and future. Mellor and Le Poidevin stress the first aspect and claim that:

(3) Event *e* is past **AND** event *e* is present **AND** event *e* is future

Lowe stresses the second aspect, pointing out that it is not the case that all these situations obtain at once. Simplifying Lowe's position

can

say that this claim is rather that:

(4) Event *e* is past **OR** event *e* is present **OR** event *e* is future

Taken in isolation neither of these aspects of change are fully adequate. (3) misses the point that these three situations never occur *at once*. (4) misses the point that these three situations must constantly be altering (since (4) would be true even if event *e* were present *forever*). So while (4) is not contradictory it needs to be supplemented with a clause stating that events *must* change their properties. In other words, we simply say: *events must change from future to present to past but it is never the case that it is past, present and future all at once.*

But recall the *rate of flow* argument of Chapter One. If all events change from future to present to past, then at any one "time" some events will be future, some present, some past. This means that there will be a given distribution of events between the three regions (past, present and future) of time. But at a later "time" this distribution will be different. So some sort of illegitimate "change" has occurred. As I argued in Chapter One this is deeply problematic: either some sort of meta-time must be invoked to provide an arena for this "change"; or this "change" must be relativised to B-Series times (which makes it only a pseudo-change); or it must be given a name like *pure becoming* and left obscure and unexplained.

I think that there is a common core problem behind both McTaggart's Paradox and the rate of flow arguments: this problem, at its simplest, is just that one cannot talk about time itself changing. The *rate of flow* arguments

stress the second aspect of change. Events are never more than one of past, present or future; but there is some kind of peculiar "change" that makes events first future, then present, then past. McTaggart's Paradox, on the other hand, stresses the first aspect of change. We do not need to dwell too much on how an event "changes" from future to present to past, since we capture this "change" by claiming that the very same event must be *all* of past, present and future. The problem here is of course that this claim is contradictory: what is lacking is the point that the event doesn't have all these properties "at once".

So despite their differences, both the *rate of flow* arguments and McTaggart's Paradox have a common source: events and times are being imagined to "change" in a situation where no change can sensibly be thought to take place.

A good way to understand this is to notice that something similar to McTaggart's Paradox can be applied to the moving-now model of passage. On this model only one moment of time has the unique privilege of being "now"; yet which moment has this privilege is ever-changing. The uniqueness of the "now" means in particular that if t(x) is "now" then t(y) cannot be "now"; the movement of the "now" means that (at different stages) both t(x) and t(y) will be "now".

Again there are two aspects of change involved here. In Chapter One the second aspect of change was stressed:

(6) The "now" is at t(x) **OR** the "now is at t(y) **OR** ...

The problem focused on in Chapter One was therefore the peculiar transition from one of these situations to the next i.e. how the "now" actually comes to move. But stressing the first aspect of change gives us:

(7) The "now" is at t(x) **AND** the "now is at t(y) **AND** ...

This claim stresses the fact that the very same "now" (so to speak) successively distinguishes each moment of time. But (7) is contradictory. From this initial contradictory premise, a version of McTaggart's Paradox begins, and progresses in a familiar way. Either (7) is understood in a tensed way:

(8) The "now" **is now** at t(x) **AND** the "now" **is now** at t(y) **AND** ...

If this makes any sense at all (which is doubtful) it can only mean something like saying that t(x) is now now. But this will start the familiar regress, since t(x) will also be now then, then now, and then then. The alternative is the tenseless interpretation:

> (9) The "now" **is tenselessly** at t(x) at t(x) **AND** the "now" **is tenselessly** at t(y) at t(y) **AND** ...

In other words, it is always the case, at t(x), that t(x) is "now". But equally it is true to say of t(y) that t(y) is "now" at t(y). Both t(x) and t(y) are "now", the difference is that t(x) is "now" at t(x), and t(y) is "now" at t(y). So the property of presentness is no longer unique: all times have it tenselessly. Also, these times are always "now": these facts never change. This effectively destroys passage.

To sum up, McTaggart's Paradox and the *rate of flow* arguments have a common root in the attempt to introduce some sort of "change" to a situation where change (or at least anything like ordinary change) simply cannot take place. Both arguments to some extent reinforce each other. McTaggart's Paradox can be avoided by saying (roughly) **P*e* OR N*e* OR F*e***; but this is at the cost of *highlighting* the illegitimate change criticised in the *rate of flow* arguments more vividly. The *rate of flow* arguments can be mitigated to a degree by saying **P*e* AND N*e* AND F*e***, since this statement places less emphasis of the obscure process of how an event actually becomes future, then present, then past; but this is at the cost of having to face an outright contradiction.

Having said this, the *rate of flow* argument is probably the most important member of this partnership, despite the fame of McTaggart's Paradox. There are two reasons for this.

Firstly, there is a difficulty in formulating McTaggart's Paradox. The orthodox version and Dummett's indexical version both appear to commit the indexical fallacy. I have argued that there is a sense in which the indexical fallacy supports the general strategy behind the paradox; I also argued that the paradox can even be applied to Lowe's alternative formulation of phrases like "*e* will be past" and "*e* is present in the past". But it has become apparent that even the basic formulation of the argument is a matter of controversy.

More importantly, the paradox can be fairly simply avoided using Lowe's response. Roughly, this means replacing the contradictory premise **P*e* AND N*e* AND F*e*** with the non-contradictory **P*e* OR N*e* OR F*e***. This is a

perfectly acceptable response: the only consequence is that the *rate of flow* argument receives greater emphasis. But anyone defending the idea of passage would most likely prefer to face the *rate of flow* argument than McTaggart's Paradox. To accept **Pe AND Ne AND Fe** is more or less to accept an inescapable contradiction. Although rejecting this premise means emphasizing the *rate of flow* argument, the charge made by the *rate of flow* argument is likely only to be that passage is left utterly obscure. This is still a serious objection, but it is a lot easier to face than an outright contradiction.

I conclude, then, that although McTaggart's Paradox can be made to work granted an initial contradictory premise, in practice this initial contradiction is avoidable. I see the value of McTaggart's Paradox, then, as more to deepen understanding of the *rate of flow* argument, and the root problem of applying change to time itself, rather than as providing a strong argument against passage in itself. McTaggart's Paradox simply shows that another way in which talking of time itself changing can lead to problems: in this case, the especially severe problem of a contradiction.

(xi) Sprigge and the Unreality of Time

In an interesting paper "The Unreality of Time", Timothy Sprigge argues that time is unreal. The structure of his argument is similar to McTaggart's. First Sprigge argues that anything worth the name of "time" would be an A-Series: it is central to the concept of time that there is a genuine distinction to be made between past, present and future, and that there is a "flow" between these three regions of time. Secondly he argues that there is no A-Series. Therefore time is unreal.

It is Sprigge's argument against the A-Series that I am interested in here. The first step is to reflect on what makes a statement like "Socrates died in 399 B.C." true. There are two options. Either this statement is made true by facts about the way the world is **now**; or it is made true by facts about the way the world **was**. If it is made true by facts about how the world was then there must be past facts i.e. the past must have some reality.

Suppose for the moment that the past has no reality, so that this statement would have to made true by *present facts*. This means that there must be something about the world *now* that makes it true that "Socrates died in 399 B.C.". Perhaps this "something" is a written and dated record of when Socrates died, or a year inscribed on a grave somewhere.

But what if someone lives and dies unknown, and every tiny trace of them is later obliterated? If present reality is needed to make statements about this person true, there may be no fact of the matter about whether that person existed or not! The statement "Person X existed long ago" needs at least some basis in reality in order to be true; but in this case there is none.

Sprigge argues that this is silly. If this person X really existed, then the fact that he existed is independent of whether or not any sign of his existence has persisted into the present moment. If so, statements about the past must be made true by some aspect of *past* reality. For example, if it is true that Socrates died in 399 B.C. then this is made true not by the presently available evidence but by *what actually happened.* What actually happened must therefore still have some sort of reality or existence.

The next step that Sprigge takes is to examine what sort of existence or reality a past event has. Suppose it is true to say that I had a toothache a week ago. As Sprigge has already argued, this toothache has to have some part in reality, in order to make this statement true.

Sprigge points out that toothaches tend to be painful: pain is part of the definition of what toothaches are. He then argues that it is part of the essential character of pain that *it is experienced by the person who has it as happening* ***now***. An integral part of a toothache (and other sorts of pain) is that it is experienced as vividly present. This means that the "presentness" of the pain/toothache must be part of that past reality which constitutes the toothache. As Sprigge writes:

> ... I would say that it is of the essence of an experience to be vividly present as an element in some consciousness, and that an event which lost this quality of presentness would not be an experience ... I conclude that the toothache can only be there as part of reality if, somehow from its own point of view, or of that of the consciousness which contains it, it is still there as a present reality ... (Sprigge [1], p.10)

If this presentness is an essential part of what a toothache is, then it follows that the toothache which now exists as past reality must still retain something of this quality of presentness. If it did not, it would no longer be a toothache, and it could not make the statement "I had a toothache a week ago" true. So from the mere fact that it is true to say that I had a toothache a week ago, Sprigge concludes that past events are somehow still "present", at least from their own point of view:

> ... the view of the past to which these reflections force us is that all past events are in some timeless sense present events from, so to speak, their own point of view ... (Sprigge [1], p.11)

Once this is granted, Sprigge says, we will be forced to conclude that the future is also present from its own point of view. This is because the moment we ourselves regard as present *is itself a future event, when seen from the perspective of the past.* For Socrates, 1996 A.D. is well into the future. But Sprigge has argued that Socrates' experiences, feelings, pains, pleasures, thoughts (in fact everything that Socrates is) must have the quality of presentness from Socrates' point of view, just as much as any of our own experiences have the quality of presentness from our point of view. In other words, Socrates' viewpoint on time is just as good as ours. According to Socrates our time is in the future; and despite being future from a perfectly valid point of view our own time is nevertheless real. How can we grant reality to what Socrates' calls future times yet deny reality to what we call future times? Sprigge answers that we must treat both cases alike and agree that what we call the future also has reality and presentness.

Sprigge uses these ideas to establish what he calls *eternalism*: all times are equally real, and all of them have the quality of presentness from their own point of view. Sprigge's eternalism is therefore close to what I have called the B-Series or tenseless view of time. The important difference is that for Sprigge the tenseless view of time is tantamount to claiming that time is unreal: all time's essential features will have been removed. The tenseless view of time shares Sprigge's belief that all times and events are equally real; the difference is that Sprigge also holds that the A-Series is an essential part of time.

Sprigge's argument in fact appears to rest on an important ambiguity in the word "present". This ambiguity allows the crucial step in the argument from the existence of past facts which make it true to say that I had a toothache to the claim that this past toothache still must have the property of being-present.

Suppose I am now having a toothache. On a metaphysical level my toothache has the property of being-present. As well as this the toothache has what might be called *presence*, in the sense that it is a vivid, overpowering factor in my experience. Presence is not exactly the same as the metaphysical property of being-present. If there is such a metaphysical property then a great number of events which I am not aware of at all (which

therefore have no presence to me) or which no one at all is aware of (which therefore have no presence to anybody) have this property.

The point is that presence is first and foremost a feature of our experience - a quality we notice when we reflect on the difference between what we are currently experiencing and what we are no longer experiencing. Presence is, roughly, the phenomenological quality that all our current experience has. Being-present, on the other hand, is a metaphysical property which attaches to events and times, and which is independent of our experience.

What Sprigge's argument shows is that a past toothache - that bit of past reality which makes it true that I had a toothache a week ago - must in some sense have the quality of presence. That is, from the point of view of the person experiencing the toothache (myself a week ago), the toothache had presence.

But it is a further step to say that the past toothache must also have the metaphysical property of being-present. The phenomenological quality of presence and the metaphysical property of being-present *may be* linked closely enough to allow this step to be taken; but they may not. One might argue that presence is precisely the quality that an experience has *just if that experience has the property of being-present.* But this needn't be the case. An experience like a toothache has the quality of presence in virtue of the (usually dominant) role that it plays in a person's consciousness at that time. Even if the past is just a vague shadow of the present, *the structure the experience had when present will be mirrored in the relation of the past toothache to the past consciousness in which the experience takes place.* In other words, the role the toothache plays in that consciousness may make it true that, from the point of view of that consciousness the toothache has presence, *even if both the toothache and consciousness that has it only have the lesser degree of reality belonging to the past.*

This distinction between (metaphysical) presentness and (phenomenological) presence shows the main flaw in Sprigge's argument. Past events may have presence (i.e. be present to a consciousness at that past time); but need not also have presentness. So Sprigge's argument does not lead to eternalism, or to accepting that the A-Series does not exist.

Chapter Four

New Models of Passage

(i) Introduction

So far in this thesis I have been working mainly with two models of passage: the "moving now" model and the "McTaggart-type" model. I used these to give more flesh to the difficult and obscure idea of time passing. Although I have tried to keep most of the arguments of the last three chapters as general as possible (in order to apply to most conceptions of passage) it may be that there are alternative models of passage that avoid or provide answers to the problems I have been discussing.

George Schlesinger, a supporter of passage, nevertheless accepts that traditional ideas of passage run into serious difficulties. But he considers McTaggart's Paradox, the rate of flow argument and other problems to be modern equivalents of Zeno's paradoxes. Zeno's arguments (the arrow, Achilles and the tortoise, etc) must be fallacious since things *do* move. But the ancient Greeks had difficulty with them, partly because the appropriate mathematics (showing how an infinite set of intervals can fit into a finite space) had not been developed. Similarly, time *does* pass. But to explain what this means may require new ideas and new ways of talking.

In this chapter I will look at four alternative ways of conceiving passage. These new models of passage are designed to capture the elusive nature of passage, but at the same time avoid the paradoxes and problems that surround the notion. The four models are: (i) A.N.Prior's view, called by Christensen the "P-Theory" of time, (ii) George Schlesinger's "possible worlds" model of passage, (iii) the "branching universe-tree" model of Storrs McCall, and (iv) the "creation of moments" model of David Zeilicovici. In each case I will examine how the problems of the last three chapters might be answered; as well as new difficulties that arise. Finally, I will discuss briefly some of Henri Bergson's ideas to see whether a different sort of approach to the philosophy of time might be of any help.

(ii) Prior and the P-Theory of Time

A.N. Prior in "Changes in Events and Changes in Things" (and numerous other works) discusses time. There are two main aspects to this theory that I will discuss: one is about the way we talk about passage, the other about the status of the past and future.

Although much of Prior's work concentrates on how we should talk about time, the main relevance here is just that our ordinary ways of talking tend to mislead us about the nature of passage. For example, consider the sentence (see Prior [1], p.43):

(1) My falling out of a punt has receded six years into the past

The way this sentence is constructed suggests a kind of McTaggart-type passage: an event (my falling out of a punt) was first future, then present, and is now receding further and further into the past. Prior is unhappy with this. He suggests that we use sentences like (1) because our minds have a tendency to try to force everything into a "subject-predicate" pattern. In this case we take the event "my falling out of a punt" as the subject and "past" as the predicate. A better way to talk, Prior says, is to use *adverbs*, such as *it is now the case that*, *it was the case that*, and *it will be the case that*. (1) then becomes:

(2) It is now six years since it was the case that I am falling out of a punt.

In this case there is a core present tense sentence ("I am falling out of a punt") that is about me and the punt and the fact that I fall out it. The adverbial element (*it is now six years since it was the case that*) then *operates* on the core sentence to place it six years in the past.

The advantage of this way of talking, in Prior's view, is that no talk of events is involved. The sentence is about me and the punt, not an event. As I have said, the main relevance of this here is that our normal ways of talking have a misleading effect on our concept of passage. When we force sentences into a subject-predicate pattern we almost inevitably start to think in terms of McTaggart-type passage (of events receding into the past, etc). But for Prior this is a wholly inappropriate way to conceive of passage and once we begin to *talk properly* he claims that this will quickly become apparent.

This point alone may seem to help with the rate of flow argument. By avoiding sentences suggestive of events "receding" or otherwise "changing", perhaps the problematic "motion" metaphor is no longer involved? But although there are no receding events or moving-nows in Prior's model, there is still change of some sort. Consider the following three sentences:

(3) It was the case that Tom is in Wales
(4) It is now the case that Tom is in Wales
(5) It will be the case that Tom is in Wales

First (5) will be true, and (3) and (4) false; as time passes (4) will become true while (5) becomes false; finally (3) will become true, and (4) false. But "becoming" (in the usual way of understanding this word) is a process which happens in time. Put simply, temporal reality - facts about what is the case, what will be the case and what was the case - changes. But if this change is anything like ordinary change it is illegitimate to apply it to time itself. So Prior's view suffers from the rate of flow arguments just as much as the "moving-now" or "McTaggart-type" conceptions of passage.

Prior himself recognises that the change involved in passage is, on a literal reading, absurd. Consider the following sentence:

> (6) It was the case that it was the case only 250 years ago that Queen Anne is dying, and is not now the case that it was the case only 250 years ago that Queen Anne is dying (see Prior [1], p.43)

This sentence expresses how the way in which Queen Anne's dying apparently becomes further and further past: it is no longer only 250 years ago, but now 251 years ago, that she died. But Prior emphasizes that this sort of change is metaphorical:

> ... this statement [6] does not record a "change" in any natural sense of that word, and certainly not a change in Queen Anne ... we could say that although what is here recorded *isn't* a change in the proper sense, it is *like* a change in fitting [the formula *it was the case that p and it is not now the case that p*] ... The flow of time, we would then say, is merely metaphorical, not only because what is meant by it isn't a genuine movement, but further because what is meant by it isn't a genuine change; but the force of the metaphor can still be explained - we use the metaphor because what we call the flow of time does fit the above formula ... (Prior [1], p.44)

The arguments of Chapter One suggested that anyone defending passage is likely to have to stress the metaphorical nature of words like "passage" and "flow" and "change" when applied to time. But I also argued that this leaves passage obscure. We know only that whatever the passage of time may mean is almost entirely different to any ordinary sense of passage, flow or change.

The metaphysical side of Prior's theory is that *only the present is real.* In the Introduction I suggested that a fairly commonsense view would be that only the present is fully real, the past is real in a slightly weakened sense, and the future is least real, a realm of vague possibility. For Prior, both past and future are entirely unreal, and the present is real *simpliciter.* "It was the case that p" and "it will be the case that p" both imply that *it is **not now** the case that p.* In other words the situation described by p is not part of present reality, but belongs to one of two species of unreality: the past which is *no longer*, and the future which is *not yet.*

This claim has been held to help solve McTaggart's Paradox. The source of the paradox was the idea that each event *e* is all of past, present and future. An implicit assumption in McTaggart's argument is that there is some reality to all three of the following situations: event *e* has the property of being-present, event *e* has the property of being-past, and event *e* has the property of being-future. But in Prior's view there is no future or past reality. If event *e* has any reality at all then it is by definition present; if it has no reality then it cannot possibly have any properties like pastness or futureness. In other words, McTaggart's Paradox fails because it is only ever part of reality that *e* is present, never that it is also past and future.

With regards to the third argument I have discussed - the *relativity of the present* argument - Prior's model has nothing to say. In fact, the problem is more extreme. This is because the distinction between past and future on one hand, and present on the other, is even more absolute and non-relative than on traditional models: the distinction is nothing less than between existence and non-existence.

From one observer's point of view, there will be a set of events, objects and people which are part of present reality. For this observer *nothing else exists.* But another observer will have a significantly different idea about what events and objects are real and present. As discussed in Chapter Three, this sort of relativisation of existence to frames of reference is deeply problematic.

As well as not providing answers to the *rate of flow* and *relativity of the present* arguments, there are independent reasons to be unhappy with Prior's

model. Firstly, there is a question about what makes statements about the past true/false. If I say that it rained yesterday, then ordinarily we might say that this is true *if it is a fact about yesterday (the past) that it rained.* But in Prior's view the past is no longer part of reality. So it cannot be the past itself that makes statements about the past true or false. In other words there is no past fact about whether it rained or not yesterday, so this fact cannot be what makes the statement "it rained yesterday" true or false.

Only what is present exists. It follows that statements about what happened in the past (it was the case that ...) will need to be made true by features of what is present. This presumably means present traces, reports, and records of past events.

But surely there are many events whose traces have been destroyed or lost. Timothy Sprigge writes:

> ... think of some trivial fact about a present or recent experience of yours, which you plan to keep private, and which it is evident no one could ever discover in the far future or would even wish to know about. Can you really say to yourself that one day it won't even be the case that you had that experience - not of course, that it will be the case that you did not have it, but simply that nothing of that sort will be the case at all? (Sprigge [1], p.3

Not only may the past simply be forgotten: it may be that what signs of the past remain may contradict each other. Suppose one reliable manuscript claims that Alfred was king in year x; but an equally reliable manuscript claims that Edward was king; and suppose that these are the only remaining records. At best it is simply indeterminate who was king in year x; at worst there is a contradiction.

This problem, together with the failure of Prior's model to answer the *rate of flow* and the *relativity of the present* arguments suggests that enough has been said to show that the P-theory of time is not the view we are looking for.

(iii) Schlesinger, Bigelow and Possible Worlds

In his paper "E Pur Si Muove", Schlesinger presents an account of passage that appeals to the notion of possible worlds. A similar account is given in "Worlds Enough For Time" by John Bigelow. The central idea is that possible worlds "can be used to keep contrary properties out of each other's

hair" (Bigelow [1], p.5). For example a short person is also large in the sense that they **could have been** large. In possible worlds terminology, there is a possible world in which that person **is** large. There is no contradiction in a person being short in the actual world (one metre tall) and large in some possible world (three metres tall), even though that person couldn't be both one metre tall and three metres tall in the *same* world.

Now apply this idea to past, present and future. Given some event *e* which is present, it is possible that *e* might have been past or future instead. Recall that the source of McTaggart's paradox was that an event seemed to be all three of past, present and future. The obvious solution was to try and avoid the contradiction by saying that the event has these properties at different times. But this led either to a vicious regress or to relativising the A-Series to B-Series times. The common ground between Schlesinger and Bigelow is to try and relativize these three incompatible properties to *worlds*. An event *e* does not suffer from the contradiction of being all three of past, present and future because *e* has these properties *in totally different worlds*. To begin with I will concentrate mainly on Schlesinger's account, since it is worked out in much more detail. Towards the end of the section - having criticised Schlesinger's account - I will turn to Bigelow to explore the central idea behind both models.

Schlesinger asks us to imagine a sequence of possible worlds W(1), W(2), ... , W(n), W(n+1), ... Now suppose that each world W(n) has the same "history" ("history" being used here in the expanded sense of "everything that happens in that world from the distant past right through to the distant future"). Events and times in Schlesinger's worlds are arranged in both a B-Series and an A-Series. The B-Series of each of these worlds are identical since they all have exactly the same history. The only way in which each world differs from the others is with regard to the A-Series. More precisely, *in each world a different moment is present.*

Schlesinger asks us to imagine that each of these worlds are actual for only a very brief period. Perhaps each world is actual only for the short time between the emission of one particle from a particular lump of radioactive material and the next emission of a particle from the lump, a period in the order of 10^{-1} to 10^{-2} seconds. Let each of these intervals between one emission and the next form a sequence of discrete "moments" m(1), m(2), m(3), ... , m(n), m(n+1), ... It is these discrete moments that Schlesinger wants to organise into an A-Series. Therefore, in each world W(1), W(2), ... , W(n), ... *a different one of these discrete moments is present.* Moment m(1)

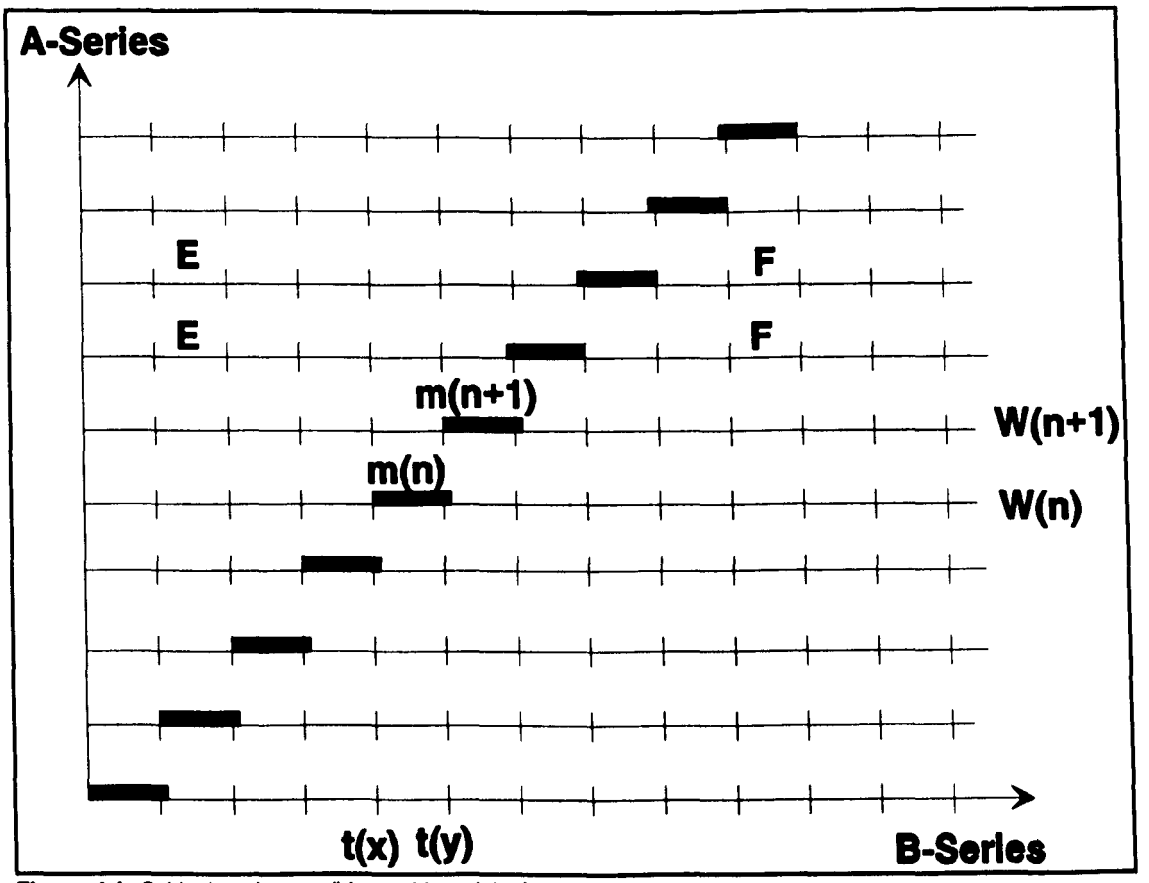

Figure 4.1 Schlesinger's possible world model of passage.

is present in W(1), m(2) is present in W(2), ... , m(n) is present in W(n). See figure 4.1.

Given this set up, passage consists *in these worlds becoming actual in succession.* First W(1) is actual, while all other worlds are only possible; and in this actual world W(1), m(1) is present. Then W(2) becomes actual, while W(1) and all the worlds after W(2) are only possible. While W(2) is actual, m(2) is present and m(1) is past. Next W(2) loses its actuality, and W(3) becomes briefly actual. And in W(3) m(3) is present, and m(1) and m(2) are past.

At any one point only one of these worlds is actual. And in this one actual world, there is a unique present moment. Further, there is dynamism in the sense that at a later time another world will be actual and therefore another moment will have the unique property of presentness.

As I pointed out above this sort of account helps deal with McTaggart's Paradox. Take the three assertions "moment t(2) is present", "moment t(2) is future", "moment t(2) is past". There is no contradiction because these three assertions are never all true *in the same world.* "Moment t(2) is present" is true when it is asserted in world W(2) and not otherwise. "Moment t(2) is past" is true when asserted in worlds later in the sequence i.e. after

W(2). "Moment t(2) is future" is true when asserted in worlds earlier than W(2) i.e. in W(1). The contradiction has been avoided by *relativising A-Series properties to worlds.*

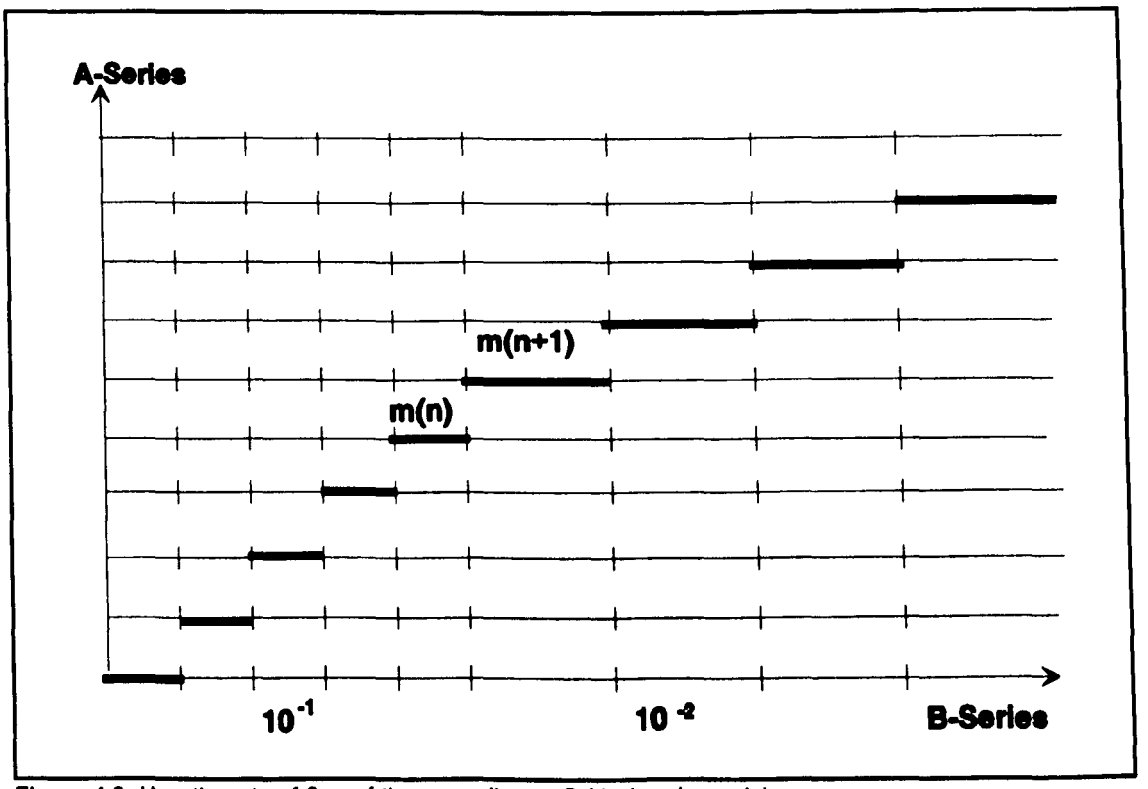

Figure 4.2 How the rate of flow of time can alter on Schlesinger's model.

Schlesinger also tries to develop an answer to the *rate of flow* argument. The rate of flow of time, he says, can be made sense of by plotting the A-Series progression of possible worlds against the B-Series time-order, as first shown in figure 4.1. Each world lasts a short interval of B-Series time (the time taken between two emissions from the radioactive lump, which will be between 10^{-1} and 10^{-2} seconds). Thus worlds could be said to succeed each other at a rate of between 10 and 100 per B-Series second. Because of the randomness of the particle emissions governing how long each world lasts, Schlesinger even considers that it is possible that this rate of flow should alter. If emissions take place at intervals of 10^{-2} for a while, then for intervals of 10^{-1} for another while, *then the rate in which worlds succeed each other will alter*, as shown in figure 4.2. Worlds in which any of the moments up to and including moment m(n) are present last only 10^{-1} seconds. Worlds in which any of the moments after m(n) are present last twice as long i.e. for 10^{-2} seconds. So time passes at exactly half of its former rate.

The problem with this answer to the *rate of flow* argument is that it is not clear that this way of charting the A-Series progression of possible worlds

against B-Series time makes much sense. In particular, there is the odd question of *how long each world W(n) lasts for.* Schlesinger says that it lasts for the brief moment m(n), which is an interval of B-Series time between 10^{-1} and 10^{-2} seconds long. But it is hard to understand what this could mean. One clear sense in which a world could be short-lived is if it had only a *short history.* That is, there is only a short period between the creation event (the first moment of time) and final Armageddon (the last moment of time). But Schlesinger's worlds cannot be short-lived in this sense, since it is a central feature of his account that all worlds W(n) have the same history i.e. the same B-Series.

What Schlesinger appears to mean is that each world W(n), complete with an entire history, possesses actuality for only a short time. But time is surely *internal* to each world. Each world comes complete with a B-Series and an A-Series (events and times *within* the world are related by earlier and later, and have the properties of past, present and future). How can the duration of a world's actuality be measured with respect to a time dimension already contained within that world? All that this internal time dimension can do is measure the length of the history of the world, from Big Bang to Big Crunch. This duration will be billions of years long. *The same time dimension cannot also be used to measure how long this world is actual.*

But in this case, must there be some sort of meta-time with respect to which worlds endure and pass away? See figure 4.3. I have already discussed problems with meta-time in Chapter One: this does not seem to be a tenable option.

So far then Schlesinger's account seems problematic. While exploring Schlesinger's answer to the rate of flow argument it has become apparent that the whole set up is confused and hard to understand. However, it may be that it is the *details* of the account that are causing the problems. In order to look more at the basic idea of using possible worlds I shall now turn briefly to Bigelow's account.

Bigelow asks us to consider a sequence of events denoted by letters of the alphabet:

abcdefghijklmnopqrstuvwxyz

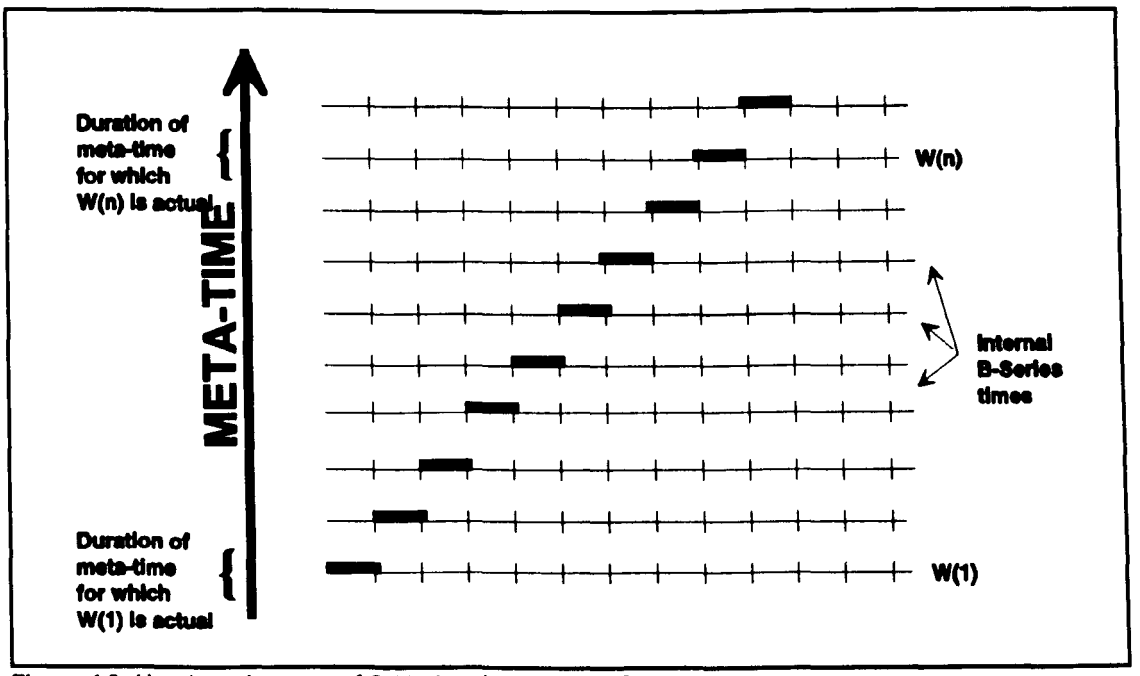

Figure 4.3 How long does one of Schlesinger's worlds last?

Suppose that one of these events is present, and the others are past or future. The exact distribution of these properties will vary from world to world. Three possible worlds might be (where past events are shown in bold, the present event is a large bold capital, and future events are in italic):

World 1: **abcdefg**H*ijklmnopqrstuvwxyz*

World 2: **abcdefgh**I*jklmnopqrstuvwxyz*

World 3: **abcdefghi**J*klmnopqrstuvwxyz*

The question I want to focus on: *is there only one out of all these worlds that is uniquely actual at a given "time" while the rest are only possible; or are each of these worlds equally actual?*

Suppose first that at any one time only one world is actual. Bigelow does not discuss this, but this is certainly the position that Schlesinger would apply to his own model. Schlesinger writes:

> We maintain that it is correct to regard the world in which we find ourselves as the actual world. What we mean by this is, not that it is actual only relative to the world in which we inhabit, since, if it were so, all worlds would be of the same status - each one is actual from its own point of view. And neither do we mean that it so from the standpoint of *every* possible world, because that would make the statement, attributing actuality to this world, *necessarily* true ... Thus, as a number of philosophers have concluded, this statement has a unique status; it is true *simpliciter*. (Schlesinger [1], p.429)

But what happens as time passes? In order for the event in the currently actual world to become past and for the next (future) event to become present, "actuality" has to somehow move or migrate from one world to another. For example if event **H** is present (i.e World 1 is actual) then when event **I** becomes present world 1 has to lose its actuality to become possible, and world 2 has to emerge from being merely possible and become actual.

This changing actuality raises the usual *rate of flow* problem. Change in the usual sense requires time, but a world changing from being possible to actual and back to possible is clearly not a process that can happen in time (since time is *internal* to each world).

One possible defence against this is to argue that a world "becoming" actual and then possible does not count as a change, and *therefore does not require time*. Granted the unique status of statements attributing actuality to a world, perhaps a case can be made to the effect that worlds gaining/losing actuality is not a change. Ordinary changes are things like traffic lights turning from red to green, cars accelerating from one speed to another, and so on. Is a whole world coming into being the sort of thing that can be described as change? If not, it would require no time (or even meta-time) in which to happen.

Perhaps this answer can be made to work, but surely it leaves a vital part of the possible worlds approach obscure. The original A-Series notion of a peculiar property of nowness attaching itself first to one event, then to another, seemed obscure and metaphorical. Changing actuality seems much more bizarre. Instead of first one event being present then another, there are now whole worlds changing from being actual to being possible in a wholly inexplicable manner.

But what if there is no "changing" actuality i.e. if all of the possible worlds have equal status. One immediate problem is that this now commits

us to a huge ontology: there must be at least as many worlds as there are times. If time is continuous and/or infinite, there must be an infinity of equally real worlds!

Perhaps more importantly, it is not clear whether this view could capture all that passage involves. It is true that within each world there is a unique past, present and future. But this distribution of past, present and future doesn't change, either in the normal sense of changing within a particular world, or in Schlesinger's sense of worlds becoming actual in succession. It is simply the case that in different equally actual worlds different moments are past, present and future. Rather than genuine change, this version of the model is essentially *static*: worlds are arrayed in fixed positions along a *possibility axis*, but overall nothing changes.

I have mentioned McTaggart's Paradox and the *rate of flow* argument. I will conclude this section by briefly looking at how the model copes with the *relativity of the present* argument. Neither Schlesinger nor Bigelow address this problem. It seems to me that there is an answer of sorts available on this model, but again this would be at a cost of a much larger ontology. The possible worlds set up could be used to preserve the non-relative character of past, present and future, by the simple expedient of having one sequence of possible worlds W(1), ..., W(n) *for each frame of reference*.

Suppose we have a possible world in which some spacetime point m(x) is present. Which of the spacetime points at a distance from this point are also present i.e. which lie on a simultaneity plane with m(x)? Different observers in different frames of reference will have different opinions about this. Usually this means that past, present and future become relative notions. But suppose that we have a plethora of possible worlds in which m(x) is present. In one world we could allow a unique universe-wide simultaneity plane containing m(x), on which every point is present. This world will clearly be associated with a particular frame of reference. But despite this past, present and future will not be relative. Every point on the simultaneity plane in this world will be present in an absolute sense. In other words, *within that particular world*, these points and only these points are present. This will be so not withstanding that there will be an alternative possible world, associated with another frame of reference, in which points on a completely different simultaneity plane are present.

In a sense this answer works. Past, present and future can remain non-relative notions without us having to reject or revise Special Relativity. But in another sense this answer just underlines the bizarre nature of the

Schlesinger/Bigelow model. The problem is solved at the cost of introducing a huge amount of whole universes.

This model then seems both bizarre and riddled with problems. Without further ado I will now look at the next alternative conception of passage.

(iv) Storrs McCall and the Branching Universe-Tree

Another attempt to find a coherent model of passage is Storrs McCall's 'branching tree' picture of the universe, presented in his 1976 "Objective Time Flow", in his 1984 "A Dynamic Model of Temporal Becoming" and most recently in his 1994 book "A Model of the Universe".

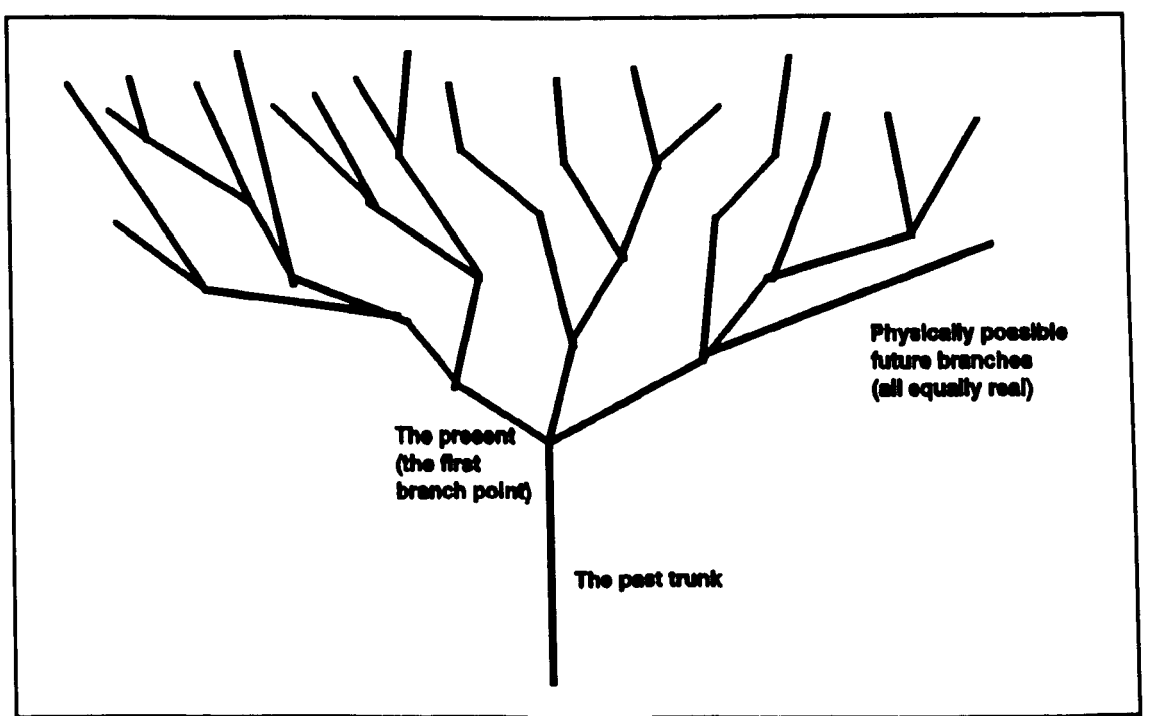

Figure 4.4 McCall's branching universe tree

The starting point of McCall's model is that the laws of physics are not strictly deterministic. Given a complete description of the world as it is now, the laws of physics do not determine a unique future: relative to this time, there are many different *physically possible* futures. In theory at least these futures form a well-defined set of possible futures, the members being those and only those which are physically possible (i.e. possible given the laws of physics and the current state of the world). This gives a picture of the universe as being like a branching tree. See figure 4.4. The trunk of the tree is the past, different possible futures are represented by the branches, and the present is located at the very first branch point above the trunk. Each

complete path through the tree from the base of the trunk upwards forms a unique four-dimensional universe, or as McCall calls them *Minkowski worlds*. McCall regards each of the branches as equally real:

> There is no 'preferred' branch, no branch which is singled out ahead of time as the one which will become actual. Instead all branches are on a par. All are equally real and, together with the trunk, constitute the highly complex ramified entity I shall call the 'universe'. (McCall [3], p.4)

But over time this "universe tree" evolves. One of the physically possible futures will be realised at the expense of all of the others. So the overall shape of the tree changes. Some of the branches get "lopped off". See figure 4.5. And it is just this process that McCall thinks constitutes time's passage or flow:

> Let us call the whole tree-like branched structure of four-dimensional manifolds "the universe". Then the dynamic feature of the universe which I suggest as the physical analogue of time flow is this: the successive shedding of "unused" branches of the tree as the first point (the present) moves upwards' (McCall [2], p.174).

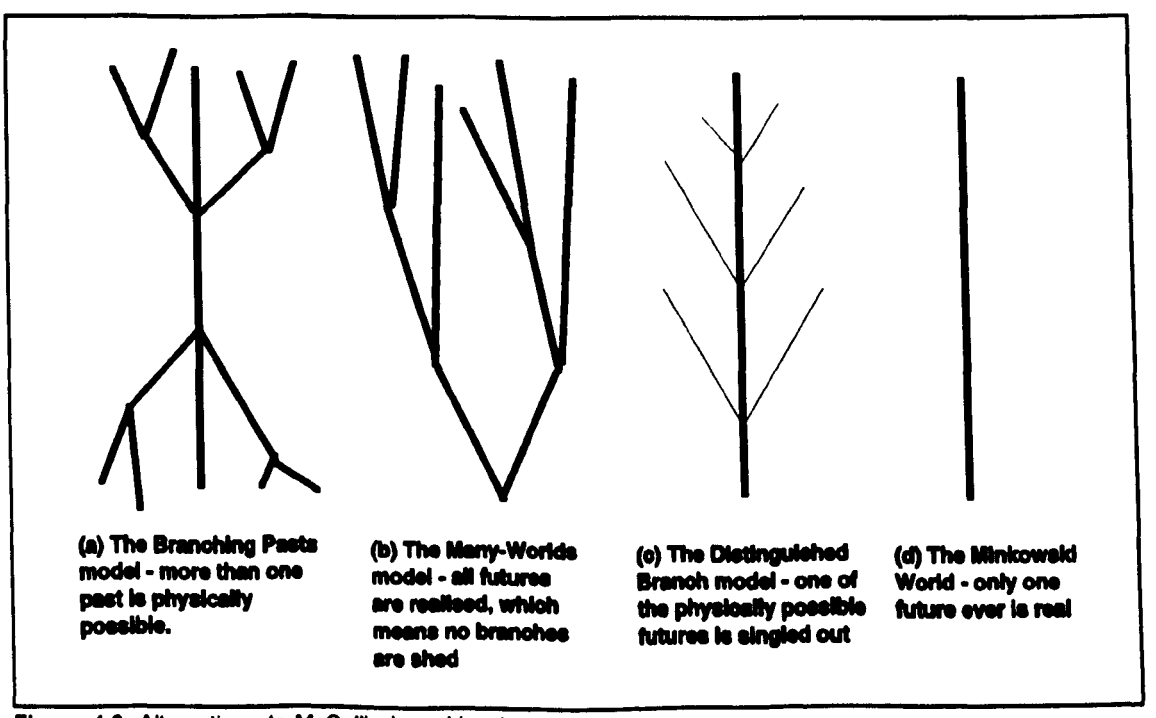

Figure 4.6 Alternatives to McCall's branching tree structure

To clarify his position McCall contrasts it with a variety of related views. See figure 4.6. In 4.6 (a) - *the branching past model* - it is assumed that as

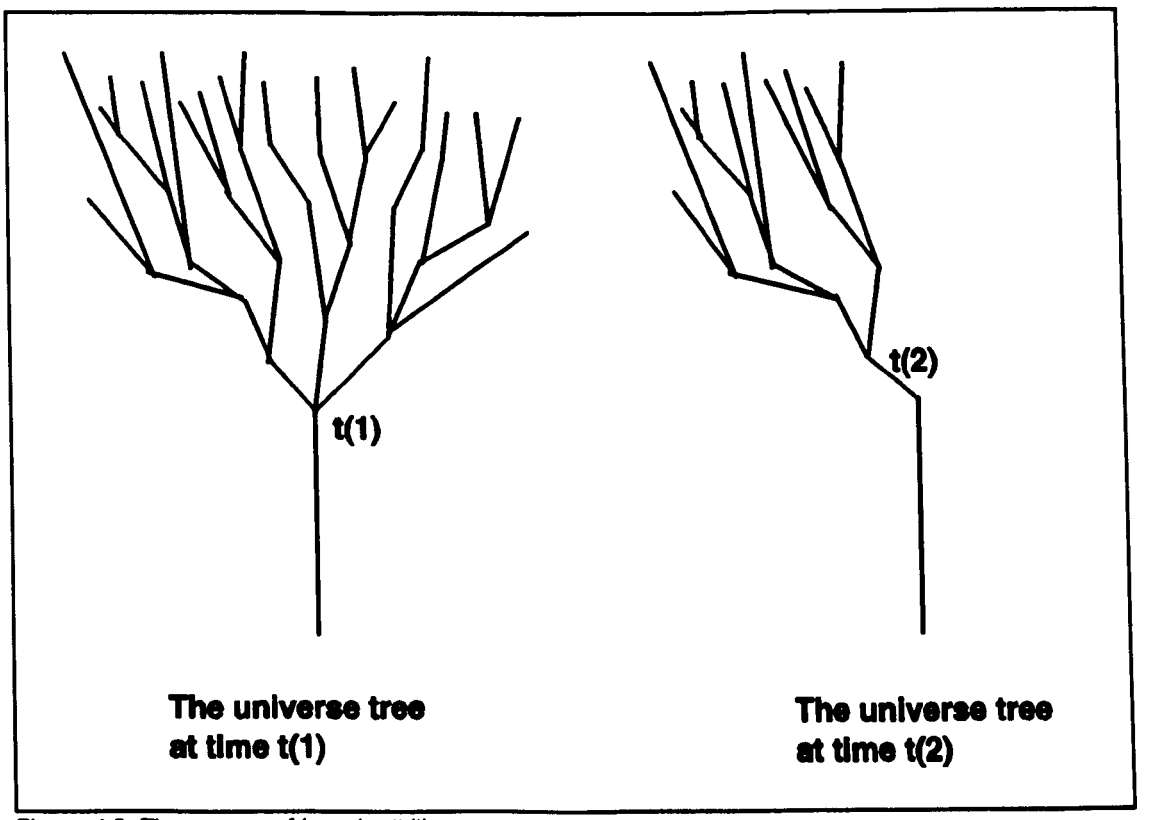

Figure 4.5 The process of branch attrition

well as different physically possible futures there are different physically possible pasts i.e. there is more than one history compatible with the way the world is now and the laws of physics. Thus in the picture there are "downwards" branches coming out of the trunk. 4.6 (b) - *the many-worlds model* - is similar to McCall's own, with the exception that no future branches are "lopped off". All physically possible futures are realised. 4.6 (c) - *the distinguished branch model* - has a variety of possible futures, all with some reality, but one of them is *singled out* beforehand as the one future which will eventually be realised. Finally 4.6 (d) is the standard Minkowski spacetime universe. Although there may be many physically possible futures, they have no ontological status: only one future (the one that is going to happen) has any reality.

McCall's own model differs from all of these: there are only many physically possible futures, not many physically possible pasts; if a physically possible future is not realised it is "lopped off" the tree and ceases to be part of the universe; there is nothing to single out beforehand which physically possible future will be realised; and finally each physically possible future is real.

How does McCall's model help with the arguments against passage? To come first to the *rate of flow* argument, the words that McCall uses to describe passage are all change-words: branches are "lopped off", "shed"; the

tree goes through a process of "attrition". But time is something internal to the tree i.e. time runs up the trunk and into the branches. Since time is already "internal" to the universe tree, there is no arena in which the tree can undergo change, or branches get lopped off.

According to Smart, since it is true that at different times there are different physically possible futures, and since there cannot be a single tree undergoing change, *there must be a vast number of trees, one corresponding to each time.* As Smart writes:

> A single spacetime universe [i.e. one of McCall's branching tree universes] surely either has branches before t or it does not have branches before t. We must suppose therefore a vast multiplicity of universes, one for each value of t. Think of a universe with branches after t but none before t as a card with a shrub drawn on it. Then McCall's picture suggests to me that there is a super-universe which is like a pack of continuum-many cards, one above the other, cards higher in the pack portraying a longer unbranched 'trunk' than those lower in the pack ... I think that McCall does not want to commit himself to this huge ontology. (Smart [2], p.82)

On this interpretation of McCall, then, there is a vast proliferation of universe trees. Furthermore there is no longer any dynamism. There is perhaps a coherent sense in which an inhabitant of a particular tree could

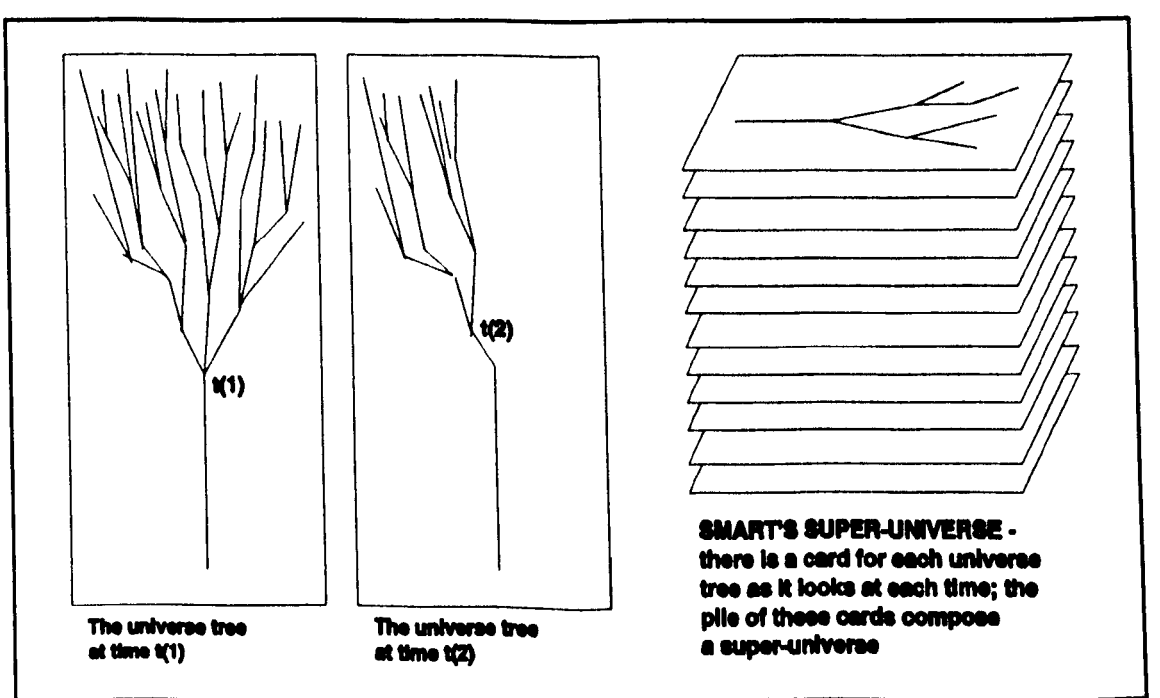

Figure 4.7 Smart's objection to McCall.

regard one moment as being uniquely present (i.e. the first branch point on that particular tree). This is settled by the topological structure of the universe tree[16]. But there is no passage. Which moment is present does not change. It is only the case that in a different tree a different moment is present. The reality is an unchanging pile of cards on which are pictured different shaped trees. See figure 4.7.

But instead of Smart's super-universe image of the stack of cards, McCall insists the situation is more analogous to a single card constantly being altered:

> the universe tree, though it changes, does not change *in* time. Rather its change constitutes the flow of time. Branch attrition, in the model, is what time flow *is*. Therefore branch attrition cannot take place in time, any more than time flow can take place in time ... Change in the universe tree *constitutes*, not time itself, but what Broad calls its 'rock-bottom peculiarity', i.e. time flow ... (McCall [3], pp.30-31)

Together with Smart, however, I cannot see how this answers the problem. If change is something that goes on in time, what does it mean to say that the universe tree changes but not *in* time? It seems no more helpful to say that branches are "lopped off" (where this "lopping off" is not remotely akin to any temporal "lopping off" of branches from an ordinary tree) than to say that the "now" moves (but not at all in the way a car moves). The process of branch attrition is completely obscure.

Turning to the *relativity of the present* argument, McCall's strategy is to embrace Special Relativity and relativise the shape of the universe tree (and hence past, present and future) to frames of reference. Indeed he writes of his 1994 book that:

> one of the principal theses of this book is that the distinction between the (single) past and the (branched) future is a frame-dependent or better hyperplane-dependent one. (McCall [3], p.35)

It is true that within the context of McCall's model some of the difficult implications of this relativisation do not apply. For McCall future and past events are as real as present ones - the only difference is that future events

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[16] It is worth pointing out that inhabitants of the tree may well have difficulty *deciding* which moment is present. Since people and events on future branches are as real as people and events at the present branch point, it seems that there is no particular way to decide if we ourselves are at the branch point, or if we are on a future branch (awaiting possible oblivion if our branch is not realised). From a God's eye point of view it may be clear which moment is present, but we do not have direct access to topological matters.

are arranged on a variety of separate branches, all but one of which will eventually be shed. So the problem of an event being both real and merely possible depending on which frame it is viewed from, does not arise. Nor does McCall hold that past, present and future are non-relative properties (since he stresses that the shape of the universe tree varies from frame to frame), so again no conflict arises.

But what different observers in different frames will disagree about is which point is the first branch of the universe tree. A branch point will not in fact be a single point in time. Rather it represents a slice through Minkowski spacetime i.e. a slice including a given event and all events judged to be simultaneous with that event. It is from this simultaneity-slice that the many future branches of the tree begin.

According to relativity, different observers will slice up spacetime in different ways. For one observer, event X will be part of the trunk (past); for another observer it will be at the branch point (simultaneous with the observer and therefore present); for yet another observer it will be on a future branch of the tree. If X is the decay of a particle, for instance, then for some observers the particle-decay is part of the trunk. For others it is at the branch point. For others the decay is on a future branch and it is not yet decided whether it will be lopped off or not (i.e. whether the particle decays or not).

It follows that different observers will have different opinions about the "shape" of the tree. Some observers will include future branches (such as the one on which the particle doesn't decay) that other observers will regard as having already been lopped off. What is at stake here is whether particular branches of the tree still form part of the tree. This is an existence-involving claim, and as I have argued such things are not easily relativised.

To put this point forcefully, some branches whose existence is under dispute may contain living beings. For the people living on these branches the question of whether the branch exists or not is surely not an empty one! It cannot be that they exist according to one observer but don't exist according to someone else.

To come finally to McTaggart's Paradox, the paradox can still be applied to McCall's model, though in a slightly different way than usual[17]. For McCall the pastness, presentness or futureness of an event is linked to the topological question of where it is situated on the branching universe tree.

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[17] This would not worry McCall since he thinks that the argument is just a sophism. In the same way as Lowe he argues that it is never true all together that an event is past *and* present *and* future: it is never the case that more than one of these contrary properties apply to the event.

The paradox starts by seeing that it is impossible for an event to be all three of "located on a branch" (future), "located at the first branch point" (present), "located on the trunk" (past). But because the tree is always "changing", each event will have all three incompatible properties (or locations). Hence the paradox applies to McCall's model as much as it applies to the traditional model considered by McTaggart himself: McCall's model neither helps nor hinders the paradox.

Moving away from the usual arguments against passage, McCall's model suffers from difficulties peculiar to itself. For instance, McCall's denial of both the existential implications of past, present and future, and of their non-relative nature, raises the question of whether his model does justice to these properties. McCall's future events, especially, are strange. Not only are future events completely real, but there are very many of them: every physically possible event that could occur is real. "The future", for McCall, refers to a huge set of alternate future branches, all of which exist. This is a long way from what is usually meant by "the future".

Again, time-flow on McCall's model works differently to the usual conception. Instead of the "spotlight" of the present moving into the future and giving life to some of the possibilities there, McCall's present is a *destroyer* of futures. As time passes, the set of real futures (in which many different physically possible events exist and happen) gets smaller and smaller. Once it may have been the case that humans developed a benign galactic civilization; but when the red button is pressed, that particular future winks out of existence. And it is not the case that my actions "bring about" one future rather than another. My actions *destroy* futures. Before I chose one of the two paths in the wood, there were real futures in which I went down both; if I chose the left path I "lop off" the entire future in which I chose the track on the right!

These oddities, together with the difficulties caused to McCall's model by the *rate of flow* argument etc, suggest that once again this alternative conception of passage does not work.

(v) Zeilicovici and the Creation of Moments

Starting from some remarks that Broad made about time, David Zeilicovici (in his 1986 "A (Dis)solution of McTaggart's Paradox" and his 1989 "Temporal Becoming Minus the Moving-Now") develops a novel account of how passage might be conceived.

Zeilicovici quotes Broad as saying "the sum total of existence is always increasing" (Zeilicovici [2], p.508). This, Zeilicovici says, could mean either that (i) as time progresses new events are constantly coming into being, although the time in which they happen was "always" there waiting to be filled, or that (ii) new moments of time themselves are constantly coming into being. To formulate the difference more precisely: an event creationist accepts that both the following two statements might be true:

(1) Event E does not exist at t(x)
(2) Event E does exist at t(y)

"Exist" here should be taken to means "part of reality", where reality is taken in a broad sense of "everything there is". Both statements can be true because on the event-creationist's view event E is created between t(x) and t(y). But for an event creationist time t(y) was "never" out of existence: it was always there waiting to be filled. A time-creationist goes even further and maintains that it may be that there is no time t(y) in existence at t(x), let alone an event occupying that time. That is, both the following statements may be true:

(3) t(y) does not exist at t(x)
(4) t(y) does exist at t(y)

In this case, reality, as it is at t(x), does not include the moment t(y). But at t(y) the (freshly created) moment t(y) has become part of reality. On this view it is not a trivial statement to say that there is (or will be) such and such a moment of future time - future moments of time do not yet exist and perhaps may never do. We can only **predict** that they will exist.

Zeilicovici gives several arguments against event-creationism. Time-creationism, he says, is a far more coherent doctrine. He then defines his own versions of the A-Series and B-Series as follows. The B-Series is what we get "just in failing to distinguish between existing moments and predicted moments" (Zeilicovici [2], p.511). That is, all moments of time, whether existent or not yet existent, are treated with equal status, and are placed in an order running from earlier to later.

Now consider the moments of time actually in existence at a given moment. All these times are ordered, from earlier to later, in a "mini-B-Series". Each of these "mini-B-Series" Zeilicovici calls an *A-Series*. The connection with the traditional A-Series is that within each of Zeilicovici's A-

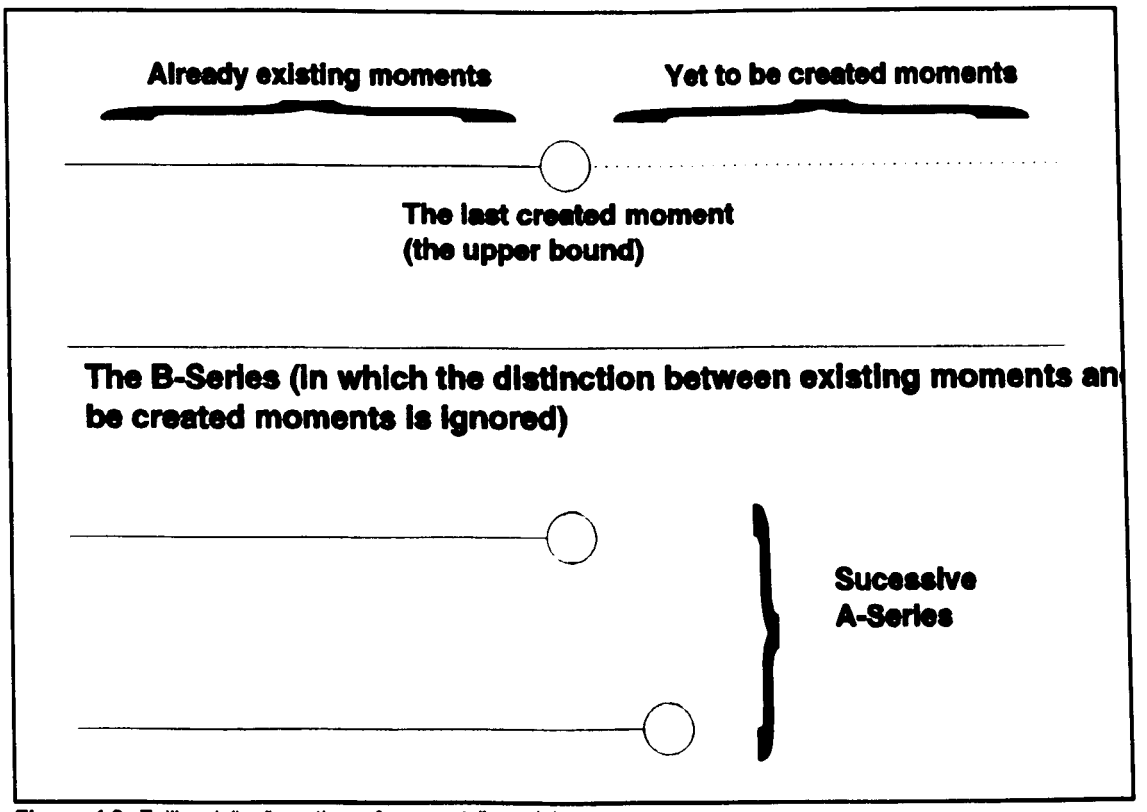

Figure 4.8 Zeilicovici's "creation of moments" model

Series a unique past, present and future can be defined. Suppose that t(y) is the latest moment in a given A-Series i.e. the last moment to have come into existence. Time t(y) is the ***upper bound*** of this particular A-Series. For Zeilicovici an event *e* is present if and only if *e* occurs at the upper bound of all the moments of time in existence. Past events are those that occur at earlier times; future events (which do not yet exist) are those that might occur at later (predicted but not yet existing) times. See figure 4.8.

Because new moments are constantly coming into existence, event *e* will be present fleetingly. Once a new moment time t(z) comes into existence, t(y) will no longer be the upper bound and event *e* will now be **past**. This constant creation of times and the consequent change in past, present and future constitute for Zeilicovici the passage and flow of time.

How does Zeilicovici's model help with the arguments against passage? To start with the *rate of flow* argument, it is not immediately clear that the model helps. Although there is no "moving now" there is the question of how this creation of moments takes place. Creation, it might be said, is as much a temporal process as "moving" - e.g. we talk of a painter "creating" a work of art. Even if we consider an object that just springs into existence, there seems to be an event - the event of the object's creation - that occurs at a particular time.

How could a time possibly be created in anything like the sense in which a work of art is created? In particular, how can a time be created *at a time*? To highlight the strangeness of this, consider how one might answer the question "*when* is this time being created?". It cannot be being created in itself: time t(y) cannot be created at time t(y), since it is not yet there for itself to be created in. It cannot be created at the immediately earlier time, since there is no such time if time is continuous[18]. It cannot be created at some other earlier time, since it was true to say at any earlier time that time t(1) did not exist.

Zeilicovici suggests, however, that creation of times is a very special sort of event that does not need time to take place in. He writes:

> The mistake in this argument is similar to that made by trying to apply ordinary arithmetic to transfinite numbers ... Our ordinary intuitions fail and mislead us when we think of creation just as they do when we think of infinity. There simply seems to be no valid reason for holding creation in general, and creation of new time in particular to be events ... There are, on the other hand, compelling reasons for not counting the increase of the time series as a change in time. By its definition such a change must have a subject, a thing which acquires and discards ordinary properties. But the moment which is being added is no such subject. It is not a thing and it is not there... (Zeilicovici [2], p.520)

There is no doubt that creation of new times is a very strange affair. Zeilicovici may well have a point in saying that this creation should not be treated as an event that needs time. On the other hand, creation of moments is an entirely obscure process. We know it cannot happen in any of the ways that we might usually understand creation (e.g. of a work of art); but we can say nothing about how it might actually happen (if it is even legitimate to talk about it "happening"). Zeilicovici's analogy with transfinite numbers breaks down at this point because we *do* have ways of understanding and working with these numbers. But creation of moments is thoroughly obscure.

Another way in which the *rate of flow* argument might apply to Zeilicovici's account is that the time-series *grows*. Given one of Zeilicovici's A-Series, this series grows by the addition of another moment. In reply to this thought Zeilicovici writes:

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[18] This is a mathematical property of continuous time. Pick a time as close as you like to any other time and there will always be another time even closer (e.g. if you pick a time 10^{-20} seconds earlier, there will be an even closer time only 10^{-40} seconds earlier, and so on).

> The addition of a new moment means a new A-Series, of which the new moment is the instantaneous upper bound. It emphatically does not mean change in time occurring to the older A-Series, which far from being increased, is being replaced. And the replacement itself is, of course, the very change of time which is the whole point of A-theory; it is certainly not a change in time ... (Zeilicovici [2], p.521)

But this again is difficult to understand. It is not clear to me how it helps to say that one A-Series is *replaced* by another (instead of a single A-Series *growing*) since both replacing and growing are usually things which occur in time. As usual this replacement is supposed to be understood as not requiring any time in which to happen. So all we know is that whatever "replacement" means in this context, it is entirely unlike anything we might usually mean. How one A-Series replaces another is entirely mysterious.

Coming to McTaggart, the paradox cannot be applied straightforwardly to Zeilicovici's model since the meanings of "past", "present" and "future" are so different. But it can be adapted. If we consider the two properties "being the latest of all created moments" and "being earlier than some other created moment" it can be seen that these properties are incompatible, yet every moment (at some point or other) must have them both. This is enough to start the usual process of contradiction and regress.

Zeilicovici, however, would reject this adaptation of the argument. The ideas behind his model of time in fact grew partly out of his reasons for rejecting the paradox, given in his 1986 paper "A (Dis)solution of McTaggart's Paradox". The main point he makes is that the paradox fails to distinguish between what he calls *ordinary* and *non-ordinary* properties. Ordinary properties, as the name suggests, are familiar, everyday properties that things *in* time might have (being white, being 6 foot tall, being made of wood, etc). More generally an ordinary property is any property P which we can deal with using time by saying that X has property P at t(x) but X does not have property P at t(y). Zeilicovici's point is that McTaggart's Paradox treats being-past, being-present, and being-future just as if they were ordinary properties; and that it is only because of this that the paradox can be set up. Non-ordinary properties are sufficiently different to ordinary properties that McTaggart's Paradox cannot apply to them.

But what exactly are these non-ordinary properties? And why exactly is a property like "being the latest of all created moments" non-ordinary? Other than the claim that non-ordinary properties are unlike ordinary

properties, I feel that the whole idea is left highly obscure. This is a familiar situation from the rate of flow argument in which the literal absurdity of passage leads to the claim that passage is metaphorical (i.e. unlike ordinary passage). In both cases this move stops the arguments from working, but at the cost of introducing the obscurity of metaphorical passage and non-ordinary properties which must be completely unlike literal passage and ordinary properties.

Coming last to the *relativity of the present* argument, Zeilicovici's model provides no answer, and nowhere does he discuss the problem. As with Prior, the difficulty this argument raises for Zeilicovici is particularly acute. Future events do not exist on Zeilicovici's model, so it will be a matter of dispute between observers in different frames of reference whether a given event exists or not. This relativisation of existence itself gives the relativity of the present argument its strongest formulation: how can an event both exist and not exist?

In fact, for Zeilicovici the problem is even more severe than for Prior. This is because even the status of *times* will be a matter of dispute. For Zeilicovici, spacetime is growing, adding to itself along the time dimension.

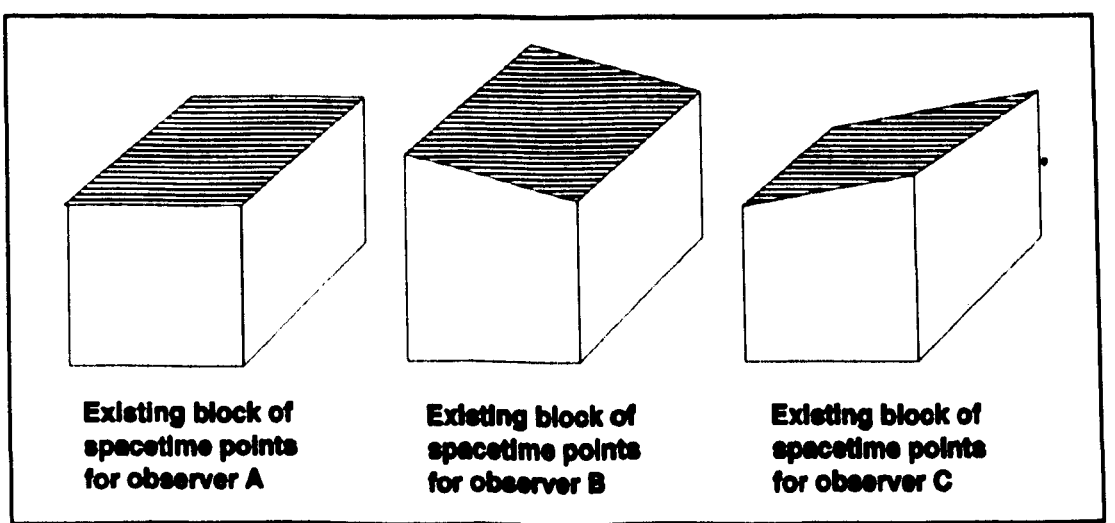

Figure 4.9. The relativity of the present argument applied to Zeilicovici: the three observers all disagree about exactly which spacetime points currently exist.

But relativity entails that different observers will disagree about which points in spacetime exist and which do not exist yet, according to which points of spacetime they judge to be on the same simultaneity plane as themselves. See figure 4.9. How can a spacetime point exist relative to one frame but not exist relative to another, or have been created in one frame but still waiting to be created in another?

Summing up, Zeilicovici's model to some extent answers the *rate of flow* argument and McTaggart Paradox, but at the cost in the first case of wholly obscure non-temporal "processes" like the creation of times themselves and the replacing of one A-Series by another; and in the second case to the obscurity of non-ordinary properties. Most seriously, no answer is offered to the *relativity of the present* argument; and this argument is further complicated since even the existence of points of spacetime will be a matter of dispute.

(vi) Bergson on Duration

Given the intuitive obviousness of tense and passage, together with the difficulty and confusion involved in trying to give a coherent account of them, it is worth asking whether some basic mistake is being made in the way the issues are approached. I will look briefly at some ideas about time (and philosophy in general) to be found in Henri Bergson's work, particularly in his essay "An Introduction to Metaphysics".

At the start of "An Introduction to Metaphysics" Bergson distinguishes between two ways of approaching metaphysical questions. One way is by *analysis*. This is essentially the way in which this thesis is being conducted. I have tried to break down the obscure and difficult notions of tense and passage and to provide some sort of explanation of what constitutes them, what implications they have, what problems arise with particular ways of conceiving them, and so on. Less familiar is the second way of approaching metaphysics. This is via the more direct knowledge obtained by *intuition*. As Bergson explains it:

> By intuition is meant the kind of intellectual sympathy by which one places oneself within an object in order to coincide with what is unique in it and consequently inexpressible (Bergson [1], p.6)

For an example, consider some character in a novel e.g. Uriah Heep from "David Copperfield". One can study and analyze the novel, list all of Heep's character traits, details of his appearance, make hypotheses about what motivates him, and so on. This is to try to understand Uriah by the method of analysis. Alternatively one can use imagination and intuition to "enter into" the way Uriah Heep is, or to "become" Uriah in the way that a very good actor might.

What is interesting in Bergson's work is his description about how the method of analysis causes difficulties when applied to metaphysical questions (especially about time). Proper metaphysical knowledge is obtained by the faculty of intuition; whereas analysis, he claims, is best applied to mechanical/practical/physical questions. According to Bergson what happens when we try to analyze something like "becoming" - the way things move and change over time - is as follows.

Firstly, from my intuitive knowledge of time (though in most of us this faculty of intuition needs to be more fully developed by the "proper" practice of philosophy) I understand that things and events are ordered in time, have certain durations, etc. From these particular orderings and durations I extract general and abstract concepts to do with temporal ordering and duration through time. In Bergson's view the part of the mind that analyses has a strong tendency to make everything *immobile* and *fixed*. This is because immobile, steady concepts are much more useful to us on a practical level. This tendency leads, then, to something very like a B-Series/tenseless view of time - an immobile, static stretch of ordered events.

But I recognize that something important about time has been left out - the dynamic qualities involved, passage, becoming, etc. Again, I have some knowledge of "becoming" through the faculty of intuition. From my intuitive knowledge of "particular becomings" like a butterfly winging its way past, or the sun setting, I can extract a notion of "becoming in general". That is I can separate the notion of becoming from any particular occurrence or process. To complete my analysis of time I superimpose this generalised notion of becoming onto the static, tenseless stretch of time and events.

The result of this process is strikingly like the "moving-now" or "McTaggart-type" concepts of time and passage, where "becoming" (the motion of the now, or the ever-changing succession of past, present and future) is superimposed onto the tenseless, static, B-Series. From these concepts numerous problems arise - as shown by the discussion of this thesis so far.

As a way of conducting metaphysics Bergson thinks this is fatal. He claims that this essentially analyses time away:

> ... concepts, laid side by side, never actually give us more than an artificial reconstruction of the object ... they present to us the shadow alone ... (Bergson [1], p.16)

Secondly, by analysing time a game of endless argument is started, thesis and anti-thesis. This is because there is more than one possible analysis. Different people will give different concepts different weight (e.g. adherents of the tenseless view of time emphasize the static qualities of time, adherents of the tensed view emphasize "becoming" and dynamic qualities). As Bergson writes:

> Everything will depend on the weight we attribute to this or that concept, and this weight will always be arbitrary ... as many different systems will spring up as there are external points of view from which the object can be examined .... Concepts ... divide philosophy into distinct schools, each of which ... carries on with the others a game that will never end ... (Bergson [1], p.18)

To discuss Bergson's points fully would take this thesis too far afield i.e. away from the problem of time to the problem of what is the best way of conducting philosophy. I shall confine myself to just a few remarks.

If we follow Bergson, then applying reason and analysis to time is bound to lead to difficulty and paradox - instead we should understand "becoming" in silence, developing and using our faculties of intuition. I am not sure though if this would be an easier/more successful path to follow. What is regarded as intuitively obvious can vary considerably from person to person. When people disagree over a chain of reasoning there is at least a way of trying to settle matters viz. discussion, trying to understand the other person's line of reasoning, looking for mistakes in one's own reasoning, and so on. If people disagree over what they apprehend through their faculties of intuition, how can they settle matters? One (or both) of the people involved need to develop their intuition further to see more clearly, but which one? (In this context probably the one who disagrees with Bergson the most).

Secondly, Bergson states that intuition sees the whole picture, enabling a person to become one with the object itself as it really is. But I am not sure that intuition, even in Bergson's strong sense of the word, is any less biased than Bergson claims analysis to be. To take the example of the actor who enters into a character in an intuitive manner: anyone who has seen different productions of the same film or play knows that equally good actors can enter into the same character in quite different ways. One can imagine this is so even if the actors in question are not the sort to think about/analyze what they are doing, but simply work by feel and intuition. If this is so, intuition is likely to result in as many disagreements and alternative points of view as analysis.

I have mentioned Bergson's work since it is at least worth being aware of alternatives; and also because it gives a warning that the passage of time may not be something which our language (and correspondingly our normal ways of thinking) can properly deal with. But since it seems likely that intuition does not offer an easier or better way of approaching time, I will carry on the rest of this thesis using (or attempting to use) reason and analysis, both to see if a coherent view of passage can be found and to see if a "passage-less" or B-Series/tenseless view of time can be made to work. If no progress is made at all, perhaps then it will be time to explore alternative methods such as Bergson's.

(vii) Conclusions

I have now looked at a wide variety of thoughts about passage. None of the accounts are free from difficulty and the concept of passage is not much clearer than before. It is helpful to draw together points from the discussion of these accounts to discover the common difficulties they suffer from.

Firstly, the fact that each of the views considered have an answer of one sort or another to McTaggart's Paradox suggests that this argument is not a decisive consideration against tense or passage. Both Prior and the Schlesinger/Bigelow account have straightforward answers to McTaggart, flowing directly from the nature of their models of time. McCall and Zeilicovici reject McTaggart's Paradox independently of their accounts. This trend ties in with Chapter Three which suggested that the argument was the weakest and most controversial of the three I have been considering.

Secondly there is the "relativity of the present" argument. Of all the accounts I have looked at only McCall explicitly deals with Special Relativity, and I argued that Special Relativity raises problems even for him. The conflict between Special Relativity and all the other accounts seems in principle unresolvable. For Prior the problem is extreme since neither past nor future events have any reality. For Zeilicovici the problem is even more extreme: neither future events *nor times* have any existence at all. For both these philosophers past, present and future have strong implications for existence which do not sit easily with the relativisation of past, present and future to frames of reference. Schlesinger and Bigelow do not really touch on this problem and there is nothing in their models of time that looks like it might help. For Schlesinger in particular the present has a special

uniqueness: in contrast to other times it is "palpably real". Again this is not a distinction that sits easily with the relativity of the present.

The difficulty in relativising the properties of pastness, presentness and futureness leaves us with three options:

(i) Accept Quentin Smith's argument that Special Relativity is not about time, but about light rays etc. The value of this approach is that if it could be done the findings of Special Relativity could be preserved, but the troublesome implications removed.

(ii) Deny, as Christensen suggested, that Special Relativity is true.

(iii) Give up the idea that the pastness, presentness or futureness of an event in any way affects that event's existence/degree of reality (or affects the event in any way at all which cannot be relativised to a frame of reference).

The first two options, as I have argued (see Chapter Two) are not very satisfactory. The third amounts to rejecting an A-Series view of time. To sum up: none of the models looked at really do anything to mitigate or avoid the relativity of the present argument.

To come finally to the *rate of flow* argument. Once again, none of the models I have considered answers this argument satisfactorily. Prior, Schlesinger, McCall and Zeilicovici all leave the idea of passage or flow obscure. In Chapter One I outlined two main outcomes of the rate of flow arguments. Firstly, people might try to use passage and flow in a literal sense: this seems to be absurd. Secondly, people might agree that passage is literally absurd, but argue that it should be understood in a metaphorical sense. The problem with this was the utter obscurity of the metaphor: no clue is given about what might underlie it.

The discussion of this chapter seems to me to reinforce these points. Prior, McCall and Zeilicovici all take the second option in which passage was taken to be metaphorical. I argued in each case that this leaves us no wiser: all we know is that the passage of time is radically different to ordinary passage. Schlesinger at least tries to develop a more literal answer to the rate of flow argument, in which world may succeed each other more quickly if a particular lump of radioactive material emits particles at a faster rate. Apart from this suggestion being very bizarre, a little examination suggested

that it made little sense. In the end the possible worlds account suffered just as much from metaphorical obscurity, in this case to do with some sort of "migrating" actuality.

In one or two places in the chapter a *third* option was taken. On this option both literal absurdity and metaphor are avoided. One example is Smart's interpretation of McCall. According to Smart, there are an infinite multiplicity of trees, one to each time. But in this case there is no genuine passage - only a tenseless, unchanging, super-universe. Another example is an interpretation of Schlesinger/Bigelow I discussed, in which all worlds are seen as equally "actual". Since each world is "always" actual, there is no change in which events are past, present and future. There is only a variation across a set of equally real worlds.

Both these accounts avoid, on the one hand, absurdity, and on the other, obscure metaphor. But the result is a model of time in which no genuine metaphysical passage occurs: both accounts are essentially static or tenseless. The third response to the *rate of flow* argument, then, avoids both literal absurdity and obscurity. The problem is that the end result appears to inevitably be an essentially static, tenseless model of time. This gives us three unattractive alternatives:

(i) Treat time's passage literally, which is absurd.

(ii) Treat time's passage metaphorically, which leaves us in complete obscurity

(iii) Explain time's passage avoiding both literal absurdity and metaphorical obscurity, but in so doing "freeze" passage into an essentially static model of time.

Overall, then, I take the *relativity of the present* argument and the *rate of flow* argument to be strong grounds for rejecting passage (McTaggart's Paradox may also raise difficulties, but this argument is much less clear cut).

(vii) Where Next?

This is not the end of the story, however. Although these arguments give strong grounds for rejecting passage, passage has not been shown to be a completely indefensible idea. All the arguments can be answered, albeit at a cost. If we are prepared to accept complete obscurity, then the *rate of flow* argument loses its force. If we are prepared to reject or radically revise Special Relativity, then the *relativity of the present* argument will fail.

The question is whether these costs are too high. The only way to decide this is to examine whether a theory of time which rejects passage is plausible. Only once we have seen this will it be possible to weigh up the "costs" on either side and make a decision.

Recall that at the start of this thesis I introduced the distinction between the tensed (or A-Series, or dynamic) view of time and the tenseless (or B-Series or static) view of time. To recap briefly: tenseless time is consisted of those aspects of time which remain when passage and metaphysical tense are removed. Tenseless time is a sequence of times/events ordered by the temporal relations of earlier than, simultaneous with, and later than.

Suppose that time is purely tenseless. This would mean firstly that times and events do not *become* past, present and future, the "now" does not move from point. Secondly all times and events are equally real. The relations earlier and later than do not have any implications for existence that make one set of times (the future) less real, or confer special privilege onto one particular moment (the "now"). Times and events in the B-Series simply *are*. This does not mean they are all present - they simply *are* in that they exist tenselessly.

Is this a defensible view? My strategy over the remaining chapters of this thesis will be to explore various objections that have been made against tenseless time and to see if they can be answered. The general plan is shown on the following page.

Chapter 5: How can tenseless time explain the prevalence of tensed ways of talking and our tensed beliefs?

Chapter 6: Is tenseless time compatible with human freedom? Does tenseless time imply that objects and people have temporal parts? If so, is this coherent?

Chapter 7: Why do we have such a strong sense of time passing if time is really tenseless?

Chapter 8: How can tenseless time explain the preferred direction from past to future that time appears to have?

Chapter 9: Can we explain why so many phenomena are directed in time (knowledge, causation, action) if time is tenseless and there is no passage?

Chapter Five

Language and Time

(i) Introduction

One problem for the tenseless/B-Series view of time is simply the pervasiveness of tense. Apart from sentences explicitly placing an event in the past, present or future, our verbs are almost always modified to include tense: I have eaten, I am eating, I will eat; Tom has been here, Tom is here, Tom will be here. On a tensed/A-Series view these ways of talking are readily understandable: they reflect the fact that time is divided into past, present and future and that there is a constant "passage" or "flow" between these properties. But on a tenseless account, time is only a "static" array of events/times ordered by the relations earlier, later, and simultaneous with. If time is tenseless, the pervasiveness and importance of tense needs some explanation. What can it mean, for example, to say "it is now raining", if this does not mean the rain has the property of presentness or nowness?

(ii) Do We Need Tense?

Perhaps the first question to ask is whether we really need to use tenses in our language. Is it possible to systematically replace sentences containing tenses and A-Series terms with purely tenseless sentences? In other words, could we theoretically speak a completely tenseless language?

Supporters of the tensed/A-Series view often tried to demonstrate that tense could not be eliminated from our language, without us losing the ability to say something important about the world. Hence (it was argued) tensed sentences convey truths about the world not capturable in tenseless terms. If tensed sentences are really necessary (if they cannot be eliminated without us losing the ability to say something important) this suggests that they pick out some genuine feature of the way the world is (that times and events are past, present and future).

Supporters of the tenseless/B-Series view, on the other hand, argued that tense could effectively be eliminated from our language, by replacing

tensed sentences with tenseless translations. If reality could be adequately described using purely tenseless language, then it was held that reality must be tenseless (i.e time is solely a B-Series).

Until recently this was one of the central questions in the debate between tensed and tenseless time. But it is now generally agreed that translation of tensed sentences by tenseless ones will not work[19]. But since the more difficult questions which I will look at later in the chapter to some extent grew out of the debate on translatability, it will be helpful to briefly outline the key points.

First, I need to introduce the distinction between *sentence-types* and *sentence-tokens*. Take as an example the sentence "It is now raining". In one sense this is a sentence that can be used by a huge number of people at a huge number of times and places. I can say today that "It is now raining"; I also said it yesterday; and Winston Churchill may have said it on a day forty years ago. One sense in which the different people saying this sentence are saying the *same* thing is brought out by saying that they all are using the same sentence *type*. The important point about a sentence *type* is that the same words are used in the same order[20].

As well as the sense in which Churchill and I use the same sentence *type*, in another sense we clearly don't say the *very same* sentence. I say my sentence in Liverpool in 1995, he perhaps said his in London in 1944; I might squeak the words quickly and in a high voice, he might have intoned them in a slow, deep voice. This is brought out by saying that we say different sentence *tokens* of the same sentence *type*, where these "tokens" are different particular instances of the general type[21].

To return now to tensed and tenseless sentences: consider a typical tensed sentence like "Tom is now in Wales" and a typical tenseless sentence like "1801 A.D. is (tenselessly) earlier than 1995 A.D.". The key difference between these two sentences becomes clear when we look at the conditions under which different *tokens* of each *type* are true. If I utter a token of "Tom

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[19] This is agreed not just by supporters of a tensed view of time, but also by supporters of the tenseless view such as J.J.C.Smart, D.H.Mellor, Nathan Oaklander, and Keith Seddon.

[20] So although there is a sense in which people saying the two sentences "it's raining now" and "il pleut maintenant" are saying the same thing, they are not using the same sentence type. The sense in which these last people are saying the same thing is that they both *assert the same facts or proposition about the world* viz. that it is raining. But they do not use the same sentence type to do this.

[21] Note that not all tokens of a type have to be spoken. I can write "it is now raining" on a piece of paper. I can even think aloud to myself "it is now raining". Although neither of these cases involve speaking out loud, they are still tokens of the general type "it is now raining".

is now in Wales" today then it will be true, because Tom is now in Wales; but if I uttered a token of "Tom is now in Wales" some time last week before Tom had gone on holiday then it would have been false.

In contrast, every *token* of the *type* "1801 A.D. is (tenselessly) earlier than 1995 A.D." will have the same truth value. If one *token* of the *type* "1801 A.D. is (tenselessly) earlier than 1995 A.D." is true, then all tokens of that type will be true. And if one *token* of the *type* "1801 A.D. is (tenselessly) earlier than 1995 A.D." is false, then all tokens of that type are false. Following Ned Markosian (see Markosian [1]) this can be put more formally:

> S is a **tensed sentence type** if and only if it is possible that a token of S at one time expresses a proposition with one truth-value and another token of S, at another time expresses a proposition with another truth-value, even if the two tokens of S refer to the same places, people and things.[22]
>
> S is a **tenseless sentence type** if and only if it is not possible that a token of S at time expresses a proposition with one truth-value and another token of S at another time expresses a proposition with another truth-value, if the two tokens of S refer to the same places, people and things.

Given these definitions, can tenseless sentences translate tensed sentences? It is clear that it is impossible to replace a tensed sentence *type* with a tenseless *type*, simply because tokens of a tensed type can vary in truth-value, whereas all tokens of a tenseless type have the same truth-value. Each time I utter a token of the type "it is now raining" I assert something different (i.e. I refer to a different time). Sometimes one of these tokens will be true; other times false. In contrast, every token of the type "it is raining at t(x)" has the same truth-value.

So if it is true that it rained at t(x), but false that it is raining at the time at which I speak, then a token of "it is raining at t(x)" will still be true but a token of "it is now raining" will be false. If "it is raining at t(x)" is supposed to be a replacement for all general purposes the tensed "it is now raining", it is very odd that the tokens of each of these types may end up having different truth-values from each other!

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[22] This last clause is necessary to exclude sentences like "*I* am tired" or "Bill has just arrived *here*" from the definition. Tokens of this sort can vary in truth-value depending on *who* says then and *where* they are said. At present, I am only interested in sentences whose truth-value varies due to difference in *when* they are, but later in the Chapter I shall have more to say about what might be called *spatially tensed* and *people-tensed* sentences.

A more likely claim is that, given any tensed token, this token can be replaced (on that specific occasion) by a tenseless token. For example, suppose I turn round to you at 3.01 p.m. on May 28th 1996 and say "It is now raining". Could I have conveyed the same message on that occasion without using tense or A-Series terms in some form?

An obvious way to try to say the same thing in tenseless language is the sentence "It is raining at 3.01 p.m. on May 28th 1996". But in this attempted translation something has been lost. Although the time referred to by "now" in the first sentence may indeed be 3.01 p.m. on May 28th 1996, you might not know this. Perhaps you have lost your watch and have no idea what time it is. Perhaps you haven't looked at a calendar recently and don't know that it is the 28th today. It may be that you don't even know what year it is (if you've been on a desert island, or in a deep coma). Since what I can convey to you by saying "It is now raining" may be different from what I convey by saying "It is raining at 3.01 p.m. on May 28th 1996", these two tokens have different meanings and the second sentence cannot be regarded as an adequate translation of the first[23].

(iii) Translation and Truth-conditions

For many years this question about translation was a central issue in the philosophy of time. The reason for this is that, as I suggested above, the untranslatability of tensed sentences seems to imply that tense is a genuine feature of the way the world is. This can be seen particularly by asking about what makes tensed sentences true. If tensed sentences are not eliminable and not trivial, some feature of the world is surely needed to make these sentences true. What makes it true that it is *now* raining? The fact that "it is now raining" cannot be translated without loss by a tenseless sentence, has suggested to some people that the answer must be that the rain has the fleeting property of presentness.

But, as I have said, it is now generally agreed that this translation is impossible. Philosophers defending the tenseless view have accepted this quite happily, but at the same time held that this has no implications about the nature of time. This is because there is no need to invoke tensed facts in

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[23] Another attempted translation might be to replace "It is now raining" with "The rain is simultaneous with this token", where "this token" refers to the token "The rain is simultaneous ...". This attempt fares a little better than the first attempt. But again it is clear that the meaning is different, since the sentence "It is now raining" makes no explicit mention of any token, and in particular doesn't refer to itself.

order to account for the truth or falsity of tensed sentences. Tenseless facts alone can account for this. As Nathan Oaklander writes:

> ... tensed discourse is indeed necessary ... but tensed facts are not since the truth conditions of tensed sentences can be expressed in a tenseless metalanguage ... (Oaklander [1]. 287)

Consider how indexicals other than "now" are treated e.g. indexicals like "I" and "here". Suppose someone says "I am tired". They speak truly if and only if they *are* tired. In general "I am tired", uttered by a person S, is true if and only if S is tired. Similarly if someone says "the postbox is here", they speak truly if and only if the postbox *is* at that place. In general, "the postbox is here" is true when uttered in place p, if and only if the postbox is at place p. The same approach apparently works for "now": "it is now raining" is true when uttered at a time if and only if it really is raining at that time. In general, "it is now raining" is true when uttered at time t, if and only if it is raining at time t.

Note that the important point is that the specified truth-conditions of "it is now raining" (the words coming after "if and only if ...") are tenseless[24]. The "fact" that makes "it is now raining" true is the tenseless fact that it is (tenselessly) raining at time t. And these tenseless truth-conditions are both necessary and sufficient for the truth of "it is now raining". Sufficient in that, if it is the case that it is (tenselessly) raining at a time t, and at that time someone says "it is now raining", then they speak truly. Necessary in that, if at the time t someone says "it is now raining" and speaks truly, then it must be the case that it is (tenselessly) raining at time t.

But if tensed sentences only require tenseless facts to make them true or false, why can't they be adequately translated by tenseless sentences? If the facts about the world which make a tensed token and a related tenseless token true are the same (i.e. both tokens pick out the same features of the world), why can't the tenseless token translate the tensed one?

In some ways this is an odd question to ask, since there are established answers to this point available from the philosophy of language. Consider the following tokens:

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[24] An alternative analysis of the truth-conditions of "it is now raining" can also be given. In this case we say "it is now raining" is true if and only if the rain is simultaneous with the utterance "it is now raining". Once again the truth-conditions are tenseless: "it is now raining" is true just in case it is a tenseless fact that the rain and the utterance of "it is now raining" are (tenselessly) simultaneous.

(i) Cicero is bald
(ii) Tully is bald

Since Cicero is in fact the same person as Tully both these tokens have the same truth-conditions: both tokens will be true if and only if the person referred to by the names "Cicero" and "Tully" is bald. But clearly these tokens are not adequate translations of each other. If someone knows the person in question only as "Cicero" then the token "Tully is bald" will not convey the same information as the token "Cicero is bald".

One traditional explanation of this is found in Frege's distinction between *sense* and *reference*. Both "Cicero" and "Tully" have the same reference (denote the same person), but they have different senses. The sense of a word is roughly the meaning it has to someone. More precisely, the sense is connected to *cognitive value*. In practice, when we are dealing with the overall sense belonging to a sentence, a criteria for distinguishing when different senses are involved is:

> If A understands [sentences] S and S', and accepts S as true while not accepting S', then S and S' have different senses (See Perry [2], p.51)

This distinction suggests why "it is raining now" cannot be translated by "it is raining at time t". Although "now" and "time t" may refer to the same time, these phrases have different senses. The fact that they refer to the same time means that the truth-conditions of both tokens are the same: they are true if and only if it is raining at the time denoted by "now" and "time t". But because they have different senses there is no guarantee that someone will understand "it is raining now" in the same way as "it is raining at time t". In other words, the tenseless token is not an adequate translation of the tensed token.

Although the above response seems to me adequate, in the remainder of this section I will outline a slightly different response, based on some of David Kaplan's ideas. It has been argued (see Perry [2]) that the traditional Fregean distinction of sense and reference needs to be revised when indexicals are involved. Other philosophers (see Gareth Evans [1]) argue that all the resources necessary to cope with indexicals can be found in Frege's work. I do not want to get sidetracked into discussing this. For present

purposes, I will accept Perry's claim that new ideas are needed to cope with indexicals[25].

The new approach I will look at here is David Kaplan's division of Frege's "sense" into two components: *character* and *content* (see Kaplan [1]). Consider the sentence "I was insulted yesterday". This sentence will always be said in a particular *context* (the context will include details about who says it, where and when it is said). The *content* of this sentence is what is said or asserted by this sentence about the way the world is. The specific content of the sentence will depend on the context. Thus, if Kaplan said this sentence on April 21st 1973, then the content (*what is asserted*) is that David Kaplan is (tenselessly) insulted on April 20th 1973.

The *character* of the sentence is, Kaplan says, close to what we might call the meaning of the words. The word "I" has the function of picking out the person who uses it. Given a context (which includes, in particular, *who* is speaking) the word "I" assigns an appropriate content to the word (e.g. David Kaplan, the speaker). Roughly speaking, Kaplan says, this is what all competent speakers understand as the meaning of "I" viz. that it functions to pick out the person using it. Similar points apply to "now" and "yesterday". The function of "now" is to pick out the time at which it is being used. The content of "now" used on April 21st 1973 is April 21st 1973. The content of "yesterday" used on the same day is April 20th 1973. In each case it is the character of the word that determines what the content will be.

This distinction enables us to explain more precisely why tensed sentences cannot be translated by tenseless ones. The sentence "it is now raining", said at 3.01 p.m. on May 28th 1996, has a content expressible by saying that it is (tenselessly) raining at 3.01 p.m. on May 28th 1996. Thus *part* of "it is now raining" is adequately translated by the sentence "it is (tenselessly) raining at 3.01 p.m. on May 28th 1996". But what this latter sentence doesn't capture is the *character*.

The "now" in "it is now raining" functions to pick out the time at which the sentence is uttered. Hence this sentence, used at different times, will have different contents (e.g. used on July 4th 1996 the content would be that it is (tenselessly) raining on July 4th 1996). In contrast "It is (tenselessly) raining at 3.01 p.m. on May 28th 1996" has a character which ensures that it expresses the *same content in all contexts* (i.e. whenever it is spoken).

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[25] Note that since these ideas are a development of Frege's work rather than a rejection, the above points about translation still hold.

This is why it cannot be an adequate translation: it has a completely different character to "it is now raining".

Note that this is a *linguistic reason.* The content of "it is now raining" (said at 3.01 p.m May 28th 1996) and "it is (tenselessly) raining at 3.01 p.m. on May 28th 1996" is the same. Since the content of a sentence is what it asserts about the way the world is, the facts needed to make these two sentences true are tenseless. What prevents the translation is a difference in *character.*

So far the discussion has shown that the untranslatability of tensed sentences by tenseless sentences does not imply that there are tensed facts. In fact it is sometimes held that the points actually *support the tenseless view.* Hugh Mellor writes:

> The sole function of tensed facts is to make tensed sentences and judgements true or false. But that job is already done by the tenseless facts that fix the truth-values of all tokens of tensed thoughts and sentences. Provided a token of "e is past" is later than e, it is true. Nothing else about e and it matters a jot; in particular no tensed fact about them matters ... Their tenseless truth-conditions leave tensed facts no scope for determining their truth-values. But these facts by definition determine their truth-values. So in reality there are no such facts ... " (Mellor [1], p.59).

I will not pursue Mellor's argument further, since I have already found enough problems with the A-Series view of time. I mention the argument to suggest that far from causing difficulties for the tenseless view of time, the issues discussed above are, at worst, neutral and, at best, supportive of the tenseless view.

(iv) Knowledge, Action and Tensed Facts

Over the rest of this chapter I will be approaching these language issues from a slightly different angle. I want to focus on *propositions.* This will brings two new problems to the fore: how to explain tensed belief[28] (e.g. the belief *that it is now raining*) and how to explain the vital role this knowledge plays in our everyday actions.

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[28] Although I will concentrate on tensed belief and tensed knowledge, the same points apply to other propositional attitudes such as desire and fear.

What are propositions? On a traditional Fregean view they have three main characteristics. Propositions are:

(a) true or false, objectively and absolutely
(b) the fundamental objects of belief and knowledge (and of psychological attitudes generally, and
(c) abstract structures that exist necessarily or in every possible world (see Sosa [1], p.317)

So for example, when I believe that the Earth is 90 million miles from the Sun, the object of my belief is the proposition *that the Earth is 90 million miles from the Sun.* This proposition has an objective, absolute (or fixed) truth. And the proposition is held to be an abstract entity (in a similar way to entities like the number two) that exists regardless of whether anyone has ever or will ever entertain it.

The most relevant assumptions at the moment are (a) and (b). If propositions are true or false absolutely then they will have to be tenseless. Tensed propositions like *it is now raining* would be true at one time and false at another, which conflicts with the idea of absolute truth. So the proposition expressed by an utterance at t(x) of "it is now raining" cannot be *it is now raining*, since this is not an eligible proposition. Instead the proposition expressed must be *it is (tenselessly) raining at time t(x).*

Turning to assumption (b), since a proposition is what people believe when they believe that such-and-such is the case, then the absolute truth of propositions will mean that *people only believe absolute truths.* In particular, when I believe that it is now raining, the object of my belief must be a tenseless proposition like *it is (tenselessly) raining at time t(x).*

These points raise a difficult question: if all propositions are tenseless and what people know/believe are propositions, how is it that people have *tensed* knowledge and belief? Suppose someone knows all there is to know about the (tenseless) history of the world, from its earliest beginnings to its last days. That is, this person knows all the true tenseless propositions about history: that Socrates dies in 399 B.C., that World War Two starts in 1939 A.D., that Brazil (say) win the World Cup in 2020 A.D., and so on. There seem to be certain essential facts that this person doesn't know. As Swinburne puts it:

> ... it does rather look as if, even if you could know the truth-value of any B-sentence [i.e. the truth of the proposition expressed by this B-sentence] you chose, there would be an all-important piece of information about the world about which you would be ignorant. You could know as much as you chose about the history of the world, as described in B-sentences, without knowing which stage that history had reached (i.e. which events were happening now). (Swinburne [1], p.118)

Connected with this puzzle about knowledge and belief is a question about action. Tensed knowledge is essential to help us *act* at the right times. When I say to you "it is raining now", this may lead you to pop back into the house to get your umbrella. Saying that "it is raining at 3.01 p.m. on May 28th 1996" may not lead you to act in this way, because you don't know that it is *now* 3.01 p.m. on May 28th 1996. So not only does there seem to be a distinct kind of *tensed* knowledge (knowledge of what is happening now) but this knowledge is essential in most of our daily actions.

An example demonstrating the problem with both tensed knowledge and action is given by John Perry in his paper "The Problem of the Essential Indexical". Suppose someone wants to go to a meeting that they know starts at noon on a particular day. This person has knowledge of the proposition *the meeting starts (tenselessly) at noon.* They may have this knowledge all day, but it will not motivate them to act. They will only act when they somehow acquire the knowledge that the meeting is starting *now.* But the proposition expressed by *the meeting is starting now* is just the tenseless proposition *the meeting starts (tenselessly) at noon* that the person knew all along! How can we explain why this person gets up and goes to the meeting at noon, when their knowledge and beliefs about the start of the meeting remain unchanged?

(v) Tensed Propositions

Richard Swinburne in his paper "Tensed Facts" argues that the source of these puzzles is that truth is commonly taken to be *absolute.* He suggests that we should abandon this idea and allow the existence of tensed propositions. If we did this *the meeting is starting now* and *it is now raining* would count as genuine propositions. What these tensed propositions assert is not that the meeting starts (tenselessly) at noon, but simply that the

meeting is starting *now*. This also appears to give an explanation of action. Only when someone believes that the proposition *the meeting is starting now* is true will they go to the meeting. During the rest of the day they don't believe that this proposition is true, and no action is taken.

The idea that propositions can be tensed is part of the broader notion of *perspectival propositions*. Perspectival propositions are not just tensed, in the sense that their truth-value can vary over time: their truth-value can also vary from place to place and from person to person. The perspectival proposition *the book is here* will vary in truth-value from place to place: true when asserted in the locality of the book and false otherwise. The truth of the perspectival proposition *I am now tall* varies according to both time and person. For example, *I am now tall* might be false for me but true for you; and although it may be true for you now it may not have been true for you when you were a child.

These details about the time, place and person involved constitute the **index**, with respect to which the truth of the proposition can be evaluated. If the index is denoted by *i*, the time by *t*, the place by *p*, and the person by *s*, then:

$$i = \langle t, p, s \rangle$$

The proposition expressed by my uttering "It is now raining" in Liverpool at 3.01 p.m. is therefore evaluated with respect to the index i = < 3.01 p.m., Liverpool, Duncan Cryle>. The proposition expressed by John Brown when he says in Scotland in 1996 that he is now tall is evaluated with respect to the index i = < 1996 A.D., Scotland, John Brown>.

Suppose, following Swinburne, that we accept perspectival propositions. What implications would this have for time? One argument might be as follows. The proposition asserted when someone says "it is now raining" is not identifiable with any tenseless proposition. Rather it is a distinct, tensed proposition. Now, what makes a proposition true or false is the way the world is. Since the proposition asserted when someone says "it is now raining" cannot be identified with any tenseless proposition, it follows that it cannot be only tenseless facts that make this propositions true or false. To make this proposition true or false *there must be tensed facts in the world (facts the pastness, presentness or futureness of the rain)*. And if there are tensed facts, time must be tensed/A-Series. If this argument is correct, then

reflections about everyday tensed beliefs and actions lead by stages to the conclusion that time must be tensed.

(vi) Spatially tensed facts and egocentric facts

I think that this argument is mistaken. But before exploring exactly why it is mistaken, I want to suggest more generally that any argument of this sort will almost certainly be false. This is simply because *exactly parallel points can be made about propositions asserted using sentences containing the words "here" and "I", but it does not follow that space or people are "tensed" or that there is a "passage of space" or a "flow of people".*

Since the same comparisons also reinforce the points made about translatability and truth-conditions in the first few sections of this chapter, I will outline briefly for both "here" and "I" how parallel points arise with regard to translation, truth-conditions and propositions.

Focusing on "here", note that there is a spatial version of the distinction between tensed and tenseless sentences. The sentence "the book is here" is "tensed" in an analogous way to "it is now raining". "It is now raining" is tensed in that tokens of this sentence uttered at different times may have different truth-values (since sometimes it is raining and sometimes it is not). "The book is here" is what we might call *spatially tensed.* By this I mean that different tokens of this sentence uttered in different *places* may have different truth-values. If the book in question is in the Philosophy Department in Liverpool, then "the book is here" is true if uttered in the Philosophy Department, but false if it is uttered in Mauritius or Zimbabwe.

Contrast this with "the book is at place p". This is similar to "it is (tenselessly) raining at time t". The sentence "it is (tenselessly) raining at time t" is tenseless in that every token of it uttered, *at whatever time*, will have the same truth-value: false it is doesn't rain at t, true if it does. In the same way every token (*wherever* uttered) of "the book is at place p" will have the same truth-value: false if the book isn't at p, true if it is. This sentence could therefore be called *spatially tenseless.*

What happens if we try to use the spatially tenseless "the book is at place p" to translate the spatially tensed "the book is here"? Suppose I turn to you and say "the book is at place p". "Place p" will usually be some accepted way of locating a place: "Smithdown Rd, Liverpool", "at grid reference ...". You may not understand that I mean that the book is *here.* This is because you may not know that "place p" is *here.* So the two

sentences "the book is here" and "the book is at place p" do not convey the same meaning, which means that "the book is at place p" is not an adequate replacement or translation for "the book is here".

Does this failure of translation have any metaphysical significance? In particular, does it mean that there are spatially tensed facts i.e. objective facts about which place is "here"? Hopefully not, since few people would accept that there is an objective fact of "hereness" in the world that makes it true to say that "the book is here". Kaplan's distinction between content and character can again be used. The point is that "the book is here" (said in place p) and "the book is at place p" express *the same content.* The difference between these sentences is merely a linguistic one: *they each have a different character.*

To come to propositions, the absolute truth of traditional propositions means not only does their truth not vary at different times, but also that it does not vary in different places. If a proposition is true at one place, it is true at every place. Thus *that the book is here* is not a genuine proposition: the proposition expressed by "the book is here" is the *spatially tenseless* proposition *that the book is at place p.*

But we do have knowledge about what place is "here". I can know that the book is *here* and this knowledge appears to be of a different kind to any spatially tenseless knowledge I might have. Suppose I have arranged to meet someone on the corner of a road: call this corner place p. All the time that I am walking along this road I know that I will meet this person *there*. When I get to place p I stop and wait, because I now believe that the meeting will happen *here*. If propositions are absolute, the proposition that is the object of both these beliefs is the same proposition that the meeting will happen in place p. So there is nothing different, on this view, between what I believed while I was walking and what I believed when I stopped. Yet clearly there is a world of difference between these beliefs: it is because of this difference that I stop walking.

Following Swinburne's diagnosis in the temporal case, perhaps the problem is that propositions are absolute. By appealing again to the idea of perspectival propositions we can accept that *the book is here* and *the meeting will occur here* are genuine propositions.

The argument for tensed time I gave above can now be repeated to show that space is tensed. The proposition asserted when someone says "the book is here" is not identifiable with any spatially tenseless proposition: the proposition involved is spatially tensed. What makes a proposition true

or false is the way the world is. It cannot be only tenseless facts that make these propositions true or false. It follows that there must be spatially tensed facts in the world (facts about hereness and thereness). This implies that space is arranged in some kind of spatial A-Series: there are metaphysical facts about which places are "here" and which are "there".

Turning to "I", a distinction can be drawn between "person-tensed" sentences and "person-tenseless" sentences. Tokens of "I am tall" vary in truth-value depending on who says them. Tokens of "Duncan Cryle is tall" all have the same truth-value whoever says them: true if Duncan Cryle is tall, false if he is not.

Person-tenseless sentences cannot be used to replace or translate person-tensed sentences. If I say to you "Duncan Cryle is tall" you may not realise that I am talking about myself (you may have no idea what my name is). But there is no need to suppose that there are special facts about "I-ness" and "you-ness". The same person-tenseless truth-conditions serve to make both "I am tall" spoken by me and "Duncan Cryle is tall" true or false. The same *content* is asserted in each sentence; all that differs is the linguistic matter of *character*.

Coming to propositions, the familiar problems arise. There is clearly a world of difference between the person-tenseless proposition *that a sharp object is flying towards Duncan Cryle's head* and the person-tensed proposition *that a sharp object is flying towards my head*. In particular, only knowledge of the person-tensed proposition will make me act: only if I know that a sharp object is flying towards *my* head will it occur to me to duck.

The familiar argument can now be used to move from the existence of person-tensed propositions to the claim that there are person-tensed facts about the world (facts about I-ness and you-ness) and that people are arranged in some kind of A-Series.

Clearly something has gone wrong here. I have tried to show that "here" and "I" can be treated in a manner closely parallel to "now". The same line of argument applies in all three cases. But it would be a very odd view that held that space and people are tensed in a similar way to time. The "now" on the tensed view is *privileged* and *moves* as time passes. Does it also follow that there is a privileged "here" and "I"? And that the privileged "here" and "I" moves from one place/person to another? This seems absurd.

The source of this puzzle is that on a metaphysical level tensed/A-Series time is supposed to be radically different to space and people, but as Markosian puts it:

> the analogies among tensed, spatially indexed and personally indexed sentence types are so close that we ought, in our semantical analysis, to treat all of these kinds of sentence types in the same manner. (Markosian [1], p.18)

According to Markosian, the only grounds that we could have to treat "now" in a significantly different way to "here" and "I" is simply that *time is already held, on grounds other than linguistic, to be tensed/A-Series*. That is, given that there is an independent argument to the effect that time is tensed/A-Series, there might be sufficient reason to treat "now" and temporally tensed propositions in a significantly different way to "here" or "I" and spatially tensed or person-tensed propositions.

This is an important point (the main point I wish to stress in the whole of this chapter) so I will go over it again. Firstly there is the claim that:

> (i) Time is radically different in its metaphysical nature to either space or people.

Secondly we have:

> (ii) The analogies between "now", "here" and "I" mean that more or less the same points can be made about them with respect to translation, truth-conditions, and the propositions they are used to express.

This means that:

> (iii) Any argument aiming to draw conclusions about the (metaphysical) nature of time on the basis of observations about "now" can also be used to draw the same conclusions about the (metaphysical) nature of space and people on the basis of observations about "here" and "I".

But since no one believes that space and people have metaphysical qualities like tense or passage this casts doubt on the soundness of any argument that has this sort of absurd conclusion:

> (iv) If an argument leads to the conclusion that space and people are tensed, and that there is a flow or passage of space and people, then that argument is almost certainly flawed.

Putting all these points together leads to the conclusion:

> (v) Any argument claiming to use facts about the way tense is used in language or the role "now" plays in our knowledge of the world to show that time has the metaphysical qualities of tense and passage is almost certainly flawed.

To repeat this one more time: the close connection between "now", "here" and "I" suggests strongly that arguments for tensed time based on the way we use sentences involving "now" or on the nature of the propositions asserted by such sentences are unlikely to be conclusive. Any proposed argument will apparently work just as much for "here" and "I"; but the absurdity of "tensed" space and people is immediate evidence that the argument is fallacious. I conclude then that none of the problems raised in this chapter for the tenseless theory of time work; and that *no similar language-based problems are in principle likely to work.*

This is why the argument from the existence of tensed knowledge and belief to the existence of tensed facts and propositions can be automatically seen to fail. However, it is interesting and illuminating to explore *precisely* why the argument fails and to offer some suggestions of what underlies our tensed knowledge and why it plays such a vital role in action.

(vii) Linguistic Modes of Presentation

I want to suggest that the key to understanding perspectival beliefs is not to make propositions perspectival[27], but to look at the way in which a proposition is "dressed up" when it is entertained in thought. Two things are needed. Firstly, we need some account of the different ways in which the same propositions can be "dressed up" so as to have a different cognitive value. Secondly, it needs to be explained how these differences are linked with action. In this section I will look at the most obvious way to approach this task. Then in sections (viii) to (x) I want to look at some ideas in a recent book by François Recanati called "Direct Reference". This book draws on insights gained in this area over the last twenty or so years, and seems to me

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[27] It is arguable that even if we accept perspectival propositions this will have no implications for time. In order to avoid absurd consequences about space and people, either the doctrine of perspectival propositions will have to be altered so that it does not imply that there are tensed facts (see Sosa [1]), or the notion of "fact" will have to be weakened so much that it has no implications for passage (see Horwich [1], Chapter Two).

to offer an elegant solution (or at least the outlines of one) to the problems I have been discussing.

First recall Kaplan's distinction between content and character. According to this distinction, the two sentence tokens "I am now hungry" (said by John Brown at time t(1)) and "John Brown is hungry at time t(1)" express the same *content* but have different *characters*. It is because these sentences have different characters that it is possible for someone to understand what is meant by one but not by the other. For example, if John Brown remarks in an impersonal way that "John Brown is hungry at time t(1)", I might not realise he is talking about himself. Or if he says simply "I am now hungry" I might not realise that the content he is asserting is *John Brown is hungry at time t(1)*. I will realise that he is talking about himself, but if I think that his name is Arthur Jones and that the time is time t(2), I will take the content to be *Arthur Jones is hungry at time t(2)*.

This distinction can be made using slightly different terminology. *Content* is analogous to the *proposition* asserted. Another way to explain the idea of *character* is to say that it is the way in which the proposition is clothed in language. More formally, the character is the *linguistic mode of presentation* of the proposition in question.

It was seen how this distinction explained why tenseless sentences cannot replace tensed sentences. Tensed and tenseless sentences may express the same content or proposition, but they do so using a different character or linguistic mode of presentation. The content or proposition involved is tenseless, so there is no need for tensed facts; yet the differing character or linguistic mode of presentation ensures that neither kind of sentence can translate the other.

A similar split can be seen to occur at the level of belief and knowledge. There is a great difference between John Brown believing *that I am now hungry* and John believing *that John Brown is hungry at time t(1)*. If John Brown believes either of these things at time t(1), the actual proposition he believes is the same. But clearly the beliefs differ: if John doesn't know who he is or what date it is, he might believe that he is now hungry but not believe that John Brown is hungry at time t(1). Again there is a distinction to be made between the actual proposition John believes and the way this proposition is presented to him.

A natural suggestion is to take what we have learned about the character and content of a given sentence token, and apply it to belief. When John believes that he is hungry at time t(1), he will express his belief by

uttering a token like "I am now hungry". *If we regard his belief simply as being a belief in the token "I am now hungry", then the character/content distinction can be straightforwardly applied to belief.* There is a world of difference between believing the token "I am now hungry" and believing the token "John Brown is hungry at time t(1)". But this is understandable in terms of the difference in *character*, not a difference in the proposition believed. In particular, the difference in character between "now" and "at time t" explains the special tensed nature of John's belief in the token "I am now hungry".

It may be that this is the right approach to take towards the puzzle of tensed belief; and that developed further an appropriate link with action could be outlined. However, at this point I want to look in depth at an alternative approach.

(viii) Recanati: Psychological Modes of Presentation

The key idea I want to take from Recanati is that as well as linguistic modes of presentations there are also *psychological modes of presentation.* Roughly, a linguistic mode of presentation is the way in which a proposition is dressed up when it is expressed in a sentence; and a psychological mode of presentation is the way in which a proposition is dressed up at the level of thought and belief.

It is clear that there are psychological modes of presentation: propositions that are the objects of belief and knowledge *are* dressed up in a certain way. What is not clear is whether these psychological modes of presentation (hereafter PMPs) are *distinct from* linguistic modes of presentations (hereafter LMPs). In the above section is was suggested that the two were identical. In this section I will outline some of the reasons that Recanati gives for thinking that they are distinct.

Recanati notes that LMPs have the following three characteristics:

(1) LMPs are "conventionally determined by the rules of language" (Recanati [1], p.69). The character of "now", for example, is a result of certain linguistic rules that determine that "now" refers to the time at which it is uttered.

(2) LMPs are constant. Although the time that "now" refers to varies with each use, the character or LMP of "now" is always the same.

(3) LMPs are token-reflexive. When "I" or "now" are used in a sentence token, they refer respectively to the person uttering the token and the time at which the token is uttered.

Recanati then goes on to argue that the modes of presentation that operate on the level of thought and belief do not have any of these three properties. Taking (3) first, Recanati notes that we are all immediately and directly aware of, for instance, our own hunger. The quality of my belief that I am hungry seems much more intimate that it would be if the "I-ness" of the belief came only from reflecting on the token-reflexive nature of my belief. When I believe that I am hungry, I do not identify myself as the person who has the belief *I am hungry*. I am directly aware that it is me myself who is hungry. Similarly, when I believe that I am *now* hungry, the tensed quality of my belief is much more intimate than it would be if this were due to the token-reflexivity of my belief. I am directly aware of the time which is "now"; not indirectly aware of it as the time at which I am holding my belief. As Recanati writes:

> ... there is something ludicrous in the suggestion that we think of objects of our indexical thoughts as 'whatever bears such and such a relation to the present token', for it implies that we think of these objects only 'by description', instead of being directly acquainted with them. (Recanati [1], p.72)

Secondly, Recanati argues that PMPs are not constant from context to context in the same way that LMPs are. Consider the difference between the belief that prompts you to say "I am hungry" and the belief that your token arouses in me (i.e. the belief that *you* are hungry). The linguistic mode of presentation linked to both our beliefs is the character of the token "I am hungry". We both understand this LMP in the same way: "I" serves to pick out the speaker (which in this case is you). But our two beliefs have an entirely different PMP. Your belief tells you "I *myself* am hungry"; my belief tells me "you are hungry". As Recanati writes:

> The linguistic mode of presentation ('the speaker') is the same for speaker and hearer, but the psychological mode of presentation, that is, the mode of presentation that occurs in the thought associated with the utterance, is different for the thought expressed by the speaker and for the thought the hearer forms upon understanding the utterance. (Recanati [1], p.73)

Another related example is when someone says "this ship (pointing through one window) is a steamer but this ship (pointing through another window) is not a steamer". (See Recanati [1], p.74). The phrase "this ship" has a constant linguistic character: it always serves to pick out the ship under discussion. Exactly which ship is under discussion is usually made clear by the context.

But supposing that the person who says this sentence is (unaware to themselves) pointing at different parts of the same ship. In this case, not only will both uses of "this ship" have the same character, but both will pick out the same ship. If the belief that the person has is governed by the LMPs associated with the sentence "this ship is a steamer and this ship is not a steamer", then the person's belief would be absurd. They would believe of the very same ship under the same mode of presentation that it is both a steamer and not a steamer. But of course this belief needn't be absurd. The person speaking believes there are *two* different ships. This can only happen if, at the level of belief, the person thinks of the "first" ship under one PMP and the "second" ship under another PMP, where these PMPs are distinct from the LMPs involved.

Finally, it automatically follows from the above points, that PMPs cannot be conventional in the same way as LMPs. Given that the same LMP (e.g. "I") can be associated with different PMPs (first-person for the speaker, and third-person for the listener), PMPs cannot be governed by the conventional rules that govern LMPs. And we may add that it seems unlikely that PMPs could be conventional at all. If I had lived my life completely separated from society and free from (external) convention, I would still be able to believe that *I* was hungry or that it was raining *now*.

(ix) Egocentric and Encyclopedic Thoughts

Given that PMPs are distinct from LMPs, what more can be said about them? According to Recanati there are three main psychological modes of presentation, *Ego*, *Hic* and *Nunc*, which correspond to the LMPs "I", "here", and "now". I will explore PMPs further using Recanati's distinction between *egocentric thoughts* and *encyclopedic thoughts*.

Roughly, egocentric thoughts are thoughts involving any of the main PMPs *Ego*, *hic*, and *nunc*. In others words they are perspectival thoughts, like the thought that it is now raining or the thought that I am hungry. Encyclopedic thoughts on the other hand are non-perspectival like the thought

that it is (tenselessly) raining at time t, or the thought that John Brown is hungry.

The key element which Recanati believes distinguishes these two kinds of thoughts is that egocentric thoughts are intimately connected with *perception*. Recanati in fact distinguishes between *three* levels or types of thought. The highest and most conceptualised level is the level of encyclopedic thoughts. At a lower level we find egocentric thought. But at the lowest level of all is *raw perception*. On this lowest level, for example, I might simply register that I see a table, without conceptualising this into the belief that *I* am seeing a table *here* and *now*.

The point about perception is that it is very perspectival. What is perceived depends upon who is perceiving, where they are, and at what time they are. Henry VIII was liable to perceive lots of courtiers and palaces. At the moment I am liable to perceive just a computer screen and the walls of my little room in the philosophy department.

Since egocentric thoughts are closely linked to perception, these thoughts are bound to be strongly perspectival. Recanati tries to clarify this by talking in terms of information and *object files*. At the most basic perceptual level, he argues, it is just as if there were *buffers* in the mind, in which incoming information is temporarily stored. Information like seeing that there is a table, or smelling someone's perfume occupies these buffers for a short time before being replaced by new information.

Suppose I am perceiving a man who is talking to me. Using the information constantly pouring into my perceptual buffers, I construct a file of information about him i.e. an object file. Into this file I put information about his appearance, his clothes, what he is saying, etc. It is at this level that egocentric thoughts come into play. In creating this object file I need to sort out, select, and conceptualise the information in the buffers. Because of the close link with perception, the object file I create will still be highly perspectival. It will be structured in a large part by the concepts *Ego*, *hic*, and *nunc*. For example, the object file will contain information to the effect that "he" (the man I am looking at) is talking to "me" about philosophy "here" (in the room I perceive around me) and "now" (at the same time as such-and-such other thoughts, feelings, and events currently forming part of my experience).

Suppose I often talk to this man. It will make sense to construct a more encyclopedic and stable object file about him, less directly linked to perception. Into this file will go information like [**name**: John Brown;

occupation: professional philosopher; **appearance**: dark hair, 5'11", beard, ...]. In other words, information about John Brown that has been acquired on many different occasions is collected together in a highly conceptualised form remote from any particular perception.

So we have three levels of thought. Firstly there is raw perception, which is strongly perspectival i.e. linked to who I am, where I am and when I am. This raw perception is conceptualised into egocentric thoughts that use the PMPs *ego*, *nunc*, and *hic*. Information gained about a particular object I am perceiving is organised into a temporary object file. Some information in this object file may then be conceptualised further and carried over into a more permanent file which is dominated by encyclopedic concepts. Egocentric thoughts are thus a *halfway house* between perspectival perception and non-perspectival encyclopedic thoughts.

(x) Recanati and the Tenseless View of Time

Recanati's ideas are extremely useful for putting flesh on the claim that perspectival beliefs and thoughts do not entail perspectival facts about "I-ness", "here-ness" and "now-ness". Rather the perspectival nature of perception means that my raw perceptions need to be organised inside a framework of *ego*, *hic* and *nunc*. Even though what underlies my perspectival thought that I am now hungry may be the proposition *Duncan Cryle is hungry at time t*, this information is presented to me inside a perspectival, perception-based framework. That is, the proposition comes under a particular psychological mode of presentation.

This link between egocentric thoughts and perception is also useful for understanding why tensed beliefs are essential to action. Broadly speaking my actions are in many cases a response to my perceptions. I see a brick coming towards my head and I duck; I feel raindrops falling on my head so I put up my umbrella.

Tensed belief is what mediates between perception and action. I feel the raindrops on my head. I conceptualise this into the egocentric thought that it is *now* raining (i.e. the thought *that it is raining at time t* presented under the PMP *nunc*). This belief combines with various desires (e.g. the desire not to get wet) to lead to my action of putting up my umbrella.

Or consider Perry's example of someone who knows *all morning* that a meeting will be starting at noon, yet only gets up to go when noon finally comes. This example is now easily understood. Suppose it is me who is

going to go to the meeting. All morning I have the tenseless belief that the meeting starts at noon, and the desire to go to this meeting. Finally, I hear the clock strike noon. I conceptualise this into the egocentric thought that it is now noon. This tensed belief then combines with my tenseless belief that the meeting starts at noon and my desire to be at the meeting, to impel me to stand up and go to the meeting. My tenseless belief and my desire are constant items, present in me throughout the morning; my tensed belief is catalyst that brings about my action.

(xi) Conclusions

I have looked at three main problems for the tenseless view. The first problem was whether the untranslatability of tensed sentences implied that time was tensed. I argued that there were no metaphysical implications: the truth-conditions of tensed sentences are tenseless, and the reason the attempted translations fail is linguistic, to do with the *character* of tensed sentences.

The second problem was that tensed belief seemed to require the existence of tensed facts. I argued that if this were so we would also have to accept spatially tensed and person-tensed facts, which seems absurd. I then took ideas from Recanati to try to show that tensed belief (and more generally, perspectival belief) does not require tensed facts (or perspectival facts). Instead, a tensed belief is a tenseless proposition *apprehended under the PMP nunc*.

The third problem was related to the second. Tensed belief is necessary for timely action. Exploring Recanati's PMPs more fully brought out the close link between egocentric thoughts and perception. This link helps us understand why tensed belief is so important to action, and exactly what role it plays. Again, this account made no appeal to tensed facts.

I conclude that the prevalence of tensed ways of talking, and the importance of tensed belief, are in no way incompatible with the tenseless view of time. Even if time is tenseless, there is no difficulty in understanding why we talk the way we do, and why we structure our experiences in terms of "I", "here", and "now". The reason behind this is simply our limited perspective. Our experience is always limited to one consciousness, one place, and one time. It is inevitable that these three limitations profoundly influence the way we talk and think.

Chapter Six

Miscellaneous Problems

(i) Introduction

In this chapter I will look at two potential problems for the tenseless theory of time. In the second half of the chapter I will be looking at how objects persist through time. In particular I will be examining the idea objects and people have "temporal parts" as well as spatial parts like arms and legs, since it is often held that tenseless time is committed to these temporal parts.

But first I will look at a problem to do with freedom. On the tenseless view there is no privileged point of time which is uniquely characterisable as "now". Consequently there is no basis for drawing a distinction between a "fixed" past and an "open" future. All times (and the events at those times) are equally real; and this includes those times and events which from our point of view are "future". But if future times and events are "already real", then surely we have no genuine choice about what we are going to do. If the event of my going for a walk at (future) time t is part of reality (i.e. my walk tenselessly occurs at time t), how can I avoid it being the case that at time t I go out for a walk? And if I cannot avoid such a simple thing as going out for a walk, the tenseless view has serious implications for my freedom.

(ii) Fatalism and the Reality of the Future

The first thing to notice is that it is not the reality of the future itself that throws doubt over my freedom. The reason that the reality of the future may affect freedom is because *it implies that there is a truth or fact of the matter about what will happen.* The idea that there is a definite truth or fact of the matter about what happens at each point of time (whether that time is past, present or future from our perspective) is called *logical determinism.* The statement that Socrates died in 399 B.C. has a determinate truth-value (in this case *true*); but equally the statement that Duncan Cryle is in Scotland on 28th July 2020 has a determinate truth-value (though it is as yet unknown to me whether this truth-value is *true* or *false*).

Suppose that this last statement is true. That is, it is a fixed tenseless truth that I will be in Scotland on 28th July 2020. What implications does this have for my freedom to either be or not be in Scotland on that date? At first sight it seems clear that in this situation I have no genuine freedom. Since it is a tenseless truth that I am in Scotland on 28th July 2020, then I *will be* there: it is just not possible for me to alter that part of tenseless reality I call "the future".

But first appearances to the contrary, I want to argue that *there are no implications that in any way limit my freedom.* To see this, it will help to consider two doctrines related to logical determinism: *fatalism* and *causal determinism.*

Fatalism is the view that whatever is going to happen in the future is going to happen *whatever I do about it.* A frequent example given is the fatalistic attitude some people are said to have had about being killed by a bomb during the Blitz in the Second World War. Someone might reason as follows. Either I will be killed by a bomb tonight or I won't be. If it's a fact that I'm going to be killed then it's futile to take any precautions (since I'm going to be killed any precautions I take clearly won't work). If I'm not going to be killed, on the other hand, any precautions are unnecessary (since I'm not going to be killed, it wouldn't matter if I stood on top of the Houses of Parliament waving a torch). It follows that whether I'm going to be killed or whether I'm not going to be killed, *there is no point in taking any precautions whatsoever.*

Causal determinism is the view that what will happen in the future is causally determined by how things are in the present. More precisely, the complete state of the universe at a given time, together with the laws of nature, determine precisely what state the universe will be in at any later time. The future positions of planets and stars, for instance, can be accurately predicted many years ahead. In so far as we ourselves are physical creatures the same laws might be held to determine all our future behaviour and decisions.

Now contrast these two views with logical determinism. Logical determinism says that if it is true that I will be in Scotland on 28th July 2020, then I will be in Scotland on 28th July 2020. If what is going to happen is that I will be in Scotland on this date, then that is what is going to happen. So in effect logical determinism says:

(A) Whatever is going to happen is going to happen

Contrast this with the (B) - fatalism - and (C) - causal determinism:

> (B) Whatever is going to happen is going to happen, *regardless of what anyone tries to do about it.*
>
> (C) Whatever is going to happen is going to happen, *and what is going to happen is causally determined by the present state of affairs in conjunction with the laws of nature.*

The point I am trying to make is that logical determinism is a distinct and fairly harmless view that entails neither (B) nor (C). That is, just because there is a fact of the matter that I will be in Scotland on July 28th 2020, this doesn't mean that I have to be in Scotland on that date *regardless of how hard I try to prevent it* or that it is *causally determined* that I will be in Scotland.

By itself, the mere fact that it is true that I will be in Scotland does not inhibit my freedom. It is not the case that on July 27th I will be stubbornly locked indoors in London, and that the forces of logic will break down the doors and drag me six hundred miles to the north. It is simply that the (free) decisions I make and the (free) actions I perform will be of such a nature that they will lead me to be in Scotland on the 28th.

These points may be made a little clearer by considering life from the point of view of a fictional character like Lewis Carroll's Alice. Consider Alice just after she sees the white rabbit running past. She spends a brief moment deciding whether or not to follow him. We might think that she is fated to choose to follow the rabbit. After all, the whole book "Alice in Wonderland" is already written. There is a truth of the matter about what she will do: this truth is that she *will* follow the rabbit.

But this truth doesn't imply that she is *fated* to follow the rabbit, in the sense that she would have followed him *whatever she did.* Alice is not like the character of Oedipus, who really was fated to kill his father and marry his mother. As it happens, Alice's choice is to follow the rabbit. But if she had decided not to follow him then she wouldn't have. If it is (tenselessly) the case that she decides not to follow the rabbit then what happened afterwards would have been different. Carroll's book would have been an uninteresting one about a girl who *didn't* follow a white rabbit, but just went back to sleep.

What I am trying to say is that the shape or plot of the book is determined by what Alice does, not vice-versa. What will happen on p.60 will happen because that is what Alice will of her own free choice and for her own

reasons decide to do. This is quite different from saying that Alice is fated to perform these actions on p.60 because it is "already written".

Similarly, there is no need for all the events in the story to be connected by a rigid causal chain. All the events of the book are in some sense already real (they are written in black and white). But although there is a definite fact of the matter about what happens on p.60 of the book, given the bizarre nature of the events in the book this is probably not connected by any normal causal chain to what happened on p.59.

Alice, of course, is only a fictional character and doesn't have the same freedom of choice that we attribute to ourselves. But the fictional example, I hope, helps to show that logical determinism (the fact that future pages are written down in black and white) implies neither fatalism nor causal determinism. If time is tenseless then I am in a similar situation to Alice when I am deliberating about whether or not to go for a walk in a few minutes. In the same way in which what Alice will decide is "already" written on the next page, my decision is "already" part of tenseless reality. But if the tenseless reality is that I decide to go for a walk, this does not mean that I am *fated* to do so. I will not go for a walk, *whatever I do*. Neither does this mean that my decisions are causally determined. A completely random decision is quite compatible with its being true that I *will* decide to go for a walk.

All that logical determinism implies is that we are going to do whatever we are going to do. But this is an empty tautological claim, not a substantial doctrine like fatalism or causal determinism. Nothing about this "tautology" in any way affects my freedom.

From my own experience I know that the harmlessness of logical determinism is hard to grasp. Surely, we think, if there is a truth of the matter about what we do in the future then our freedom is limited. But as I have tried to show by using Alice as an example, the truth that someone performs action A in the future rests upon the fact that this person will (freely) perform action A. It is not the case that the person will perform action A because it is already a fixed truth that they do. In Storrs McCall's words:

> The notion of truth, so to speak, bakes no bread, it simply floats on top of whatever events occur or will occur and in no way constrains or affects the possibility of any of them occurring ... What is true depends upon what will exist and what will occur, but what will exist and what will occur does not depend upon what is true. (McCall [2], p.176)

I conclude that the reality of the future, and the fact that there are "fixed" future truths, in no way constrains our present freedom to act[28].

(iii) Endurance and Perdurance

The second topic I will look at in this chapter is that of *temporal parts*. In our ordinary view objects and people have *spatial parts*. A chair, for instance, has four legs, a seat and a back. People have arms, legs, bones, muscles, lungs, heart. *Temporal parts* also have a place in our ordinary way of looking at the world, but only when we are talking about events and processes, not objects. A symphony is usually made up of three movements, and each movement is thought of as *part* of the symphony. World War Two is an event extending over several years. The German invasion of Poland, the British escape at Dunkirk, the Blitz over London, are all parts of this event.

It is often assumed, however, that the tenseless view of time is committed to *objects* having temporal parts. It is also often argued that the idea that objects have temporal parts is incoherent, or at least mistaken. If this is so, the tenseless theory of time faces a difficult problem.

Why might the tenseless view be thought to imply that objects have temporal parts? Consider two ways in which objects might be thought to persist through time. In our ordinary way of thinking, we regard objects like tables, chairs, cars, etc as *wholly present* at each time at which they exist. The chair before me now is the *whole* chair - it does not have other bits or parts existing at different times. The chair may have a lifetime of several years; but whenever we come across the chair during those years we will find the whole chair occupying that one particular time. The claim that the chair persists through time then amounts to saying that the whole chair occupies each time between two dates. If the chair is manufactured on 1st January 1990 and persists until it is destroyed in a bonfire on 5th November 1996, then the chair will have been wholly present at each time between these dates. This way of understanding an object persistence through time can be called *enduring*.

An alternative is to regard objects as *perduring*. In this case objects are *not* wholly present at any one time: they are spread out across time. What we come across at any given time is only that portion of the object

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[28] This conclusion may be familiar from several other settings. It is one response to Aristotle's puzzle about the sea battle, which might otherwise be taken to imply that future propositions have no definite truth value. It has also been used to reconcile God's foreknowledge with human freedom.

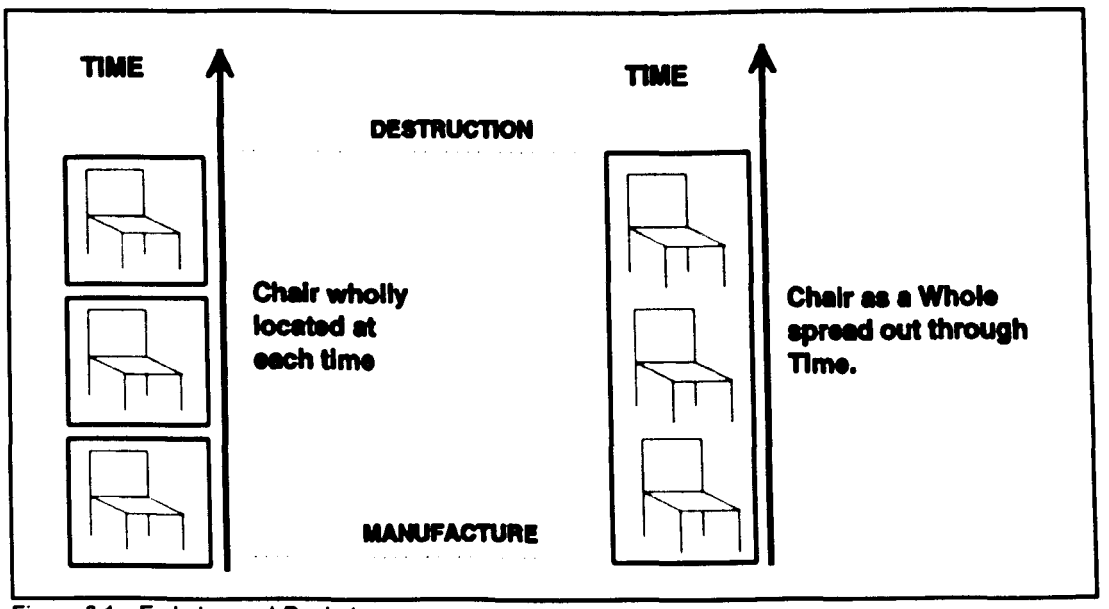

Figure 6.1. Enduring and Perduring

which occupies that time. As it is usually understood (though I will argue that this needn't be the case) perdurance is taken to imply that objects are composed of temporal parts. To come back to the chair, what we come across at any given time is not the "whole" chair. The "whole" chair, in this context, is a temporally extended object, stretching from 1st January 1990 (manufacture) to 5th November 1996 (destruction). At any one time all we find is a temporal part, stage or slice of the whole chair. Traditionally (though again I will argue that this needn't be the case) these temporal parts are regarded as instantaneous time-slices of objects: the part of an object *occupying one particular instant*. A time-slice of a chair A can be designated by terms like *A-at-t(1)*, *A-at-t(2)*, etc.

The tenseless view of time is taken to imply that objects have temporal parts since it is thought that:

(i) the tenseless view of time is incompatible with objects enduring.

(ii) Since objects don't endure then they must perdure, and perdurance implies that objects have temporal parts.

Given these two points, some opponents of the tenseless view have then tried to show that:

(iii) the doctrine of temporal parts is mistaken or even incoherent.

If all these points hold, the tenseless view suffers from serious difficulties. I will examine each of these points in turn. I will argue firstly that the tenseless view is not incompatible with the view that objects endure. Secondly, I will argue that even if it is held that objects perdure, this does not mean that they automatically have temporal parts. Finally I will argue that the view that objects perdure and have temporal parts is defensible. The conclusion will be that questions about endurance, perdurance, and temporal parts do not raise difficulties for the tenseless theory of time.

(iv) Endurance and Tenseless Time

Firstly, then, why might the tenseless view be thought to be incompatible with the idea that objects endure? When an object endures, it is wholly present at a number of different times. It is natural to ask how the same object can be both wholly at one time and wholly at another. The obvious solution is that the whole object will occupy first one time, then another. When it is occupying the first time, it is wholly there, and not at any other time. When it is occupying the second time, it is no longer at the first time, but wholly at the second. Thus the object *successively* occupies a variety of times: the whole object *moves* from one time to the next.

But this "movement" from one time to another involves just the sort of illegitimate change denied by the tenseless view. If a whole object - a chair - occupies and is confined to a single time t(1) then it is tenselessly true both that the chair occupies t(1) and that the chair doesn't occupy time t(2). This means that it is impossible for it to somehow come to be the case that the chair no longer tenselessly occupies t(1), but now tenselessly occupies t(2).

Movement through time is incompatible with the tenseless view, but is this idea of objects moving through time the only way to make sense of endurance? Some tenseless theorists - most notably Hugh Mellor - clearly think that endurance does not have to be conceived in this tensed way. For instance, Mellor writes:

> ... only events have temporal parts; things do not. It was not just a temporal part of Everest that temporal parts of Hilary and Tenzing first climbed: both men and mountain were wholly present throughout all the temporal parts of that historical event. (Mellor [1], pp. 8-9)

How can this be? How can the same object wholly and tenselessly occupy a number of distinct times? If it is true to say both that an object A

is tenselessly at t(1) and object A is tenselessly at t(2), how can the object be wholly at either time? Surely part of it must be at t(1), and part of it at t(2)?

The reply to this comes from reflecting on the use of the words "whole" and "part" as we apply them to objects. "Part" applied to an object means primarily a spatial part. If we ask someone to tell us about the parts of a chair, they will talk about the chair's spatial parts ("Well, it has four legs, a seat, and a back"). The "whole" chair, in ordinary usage, refers to the complete, assembled, collection of its spatial parts. If someone rips the chair into its component spatial parts, so that its legs, seat and back are scattered across the floor, the chair is no longer whole: it has been split up into its component parts.

Using the word "part" in this ordinary way means that it makes little sense to ask if an object has parts at different *times*. By definition, an object's parts are spatial: they are the spatial bits and pieces that occupy the same time as the object and serve to make up or compose the object. Similarly, the ordinary use of "whole" means that it is correct to call an object "whole" simply if all its component spatial parts are in place. When we come across an assembled chair, what we see is the "whole" chair: there are no other parts hidden from us or occupying other times.

On this approach it is simply a mistake to talk about objects having temporal parts. It may be the case that object A is tenselessly at t(1) and also tenselessly at t(2), but A can still be wholly present at each time. All this means is that the object is correctly assembled with all its component spatial parts at t(1), and also at t(2).

I can see no reason why someone holding the tenseless view of time would have to alter or reject the ordinary ways in which "part" and "whole" are applied to objects. Just because the chair I am now sitting on tenselessly occupies other times, there is no reason to think of this chair as somehow incomplete, or only one of many "temporal parts". However, this may seem mistaken to some people, so over the next few sections I will look at and defend the notions of perdurance and temporal parts[29].

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[29] It is worth mentioning that endurance is not a trouble-free notion. Although I will not discuss problems with endurance here, some philosophers (even philosophers with no special interest in time) have found perdurance to be a far more satisfactory view.

(v) More About Parts and Wholes

Before looking at perdurance and temporal parts, it will be helpful to distinguish between strong and weak senses of the words "part" and "whole". When talking about the spatial parts of a chair in the stronger sense of "part" the parts are: four legs, a seat, and a back. This is the natural and commonsense way to divide the chair. What underlies this approach is the idea that a part should be clearly distinguishable, whether this is done in terms of function, general shape, colour, etc. Not just any random division of the chair (a small slice of the back, or a thin line through the seat) counts as a part in this strong sense.

Similarly, a symphony naturally falls into three main temporal parts i.e. into three movements. Each movement itself will fall into parts (opening theme, piano solo, quiet ending, etc). Again these parts are clearly distinguishable by their role or volume, or by which instruments are involved. A random selection of notes will not in general form a part in this strong sense. The last few notes of the first movement together with a silence and the first few notes of the second movement is not in this sense a genuine part.

At the other end of the scale from this strong notion of part, is a very weak, inclusive sense used in mereology. In this weak sense every region of spacetime, however large or small, is a part. Corresponding to this weak sense of "part" is an equally weak sense of what makes a "whole". In mereology any collection of (weak) parts makes a whole. My big toe, a phrase from Beethoven's 5th Symphony, and a small group of particles out in space, together make up a whole object. This is clearly very different to the sense of "whole" which would be associated with the stronger sense of "part". In this stronger sense, for something to be a whole object or a whole process, many criteria must be met. Applying these criteria allows a chair or symphony to be regarded as "whole" but excludes many other collections of parts, even if these parts are all parts in a strong sense (e.g. the leg of a chair, the arm of a person, and the wheel of a car are all strong parts, but do not combine to form a proper "whole").

(vi) Does Perdurance Imply Temporal Parts?

At the heart of the idea of perdurance is simply the claim that an object is *not* wholly present at any one time of its existence, but temporally spread

out across all times between its creation and destruction. This core idea is captured by what Le Poidevin calls the *minimal thesis of temporal parts*. This label is somewhat confusing, since the thesis is not about temporal parts at all, but separates the core claim behind perdurance from the idea that an object has temporal parts. Le Poidevin writes:

> ***Minimal Thesis***: It is not the case that a temporally extended object is wholly located (i.e. has its entire temporal extension) at each of the many times which constitute its temporal extension. In this respect time is like space: a spatially extended object is not wholly located (i.e. has its entire spatial extension) at each of the many minute places which constitute its spatial extension. (see Le Poidevin [2], p.62).

The minimal thesis is little more than a denial that objects are wholly located at one time i.e. to a denial that objects *endure*. Instead, what we come across at any one time is only a portion of a temporally extended object. *What the thesis does not say is anything about the nature of these portions i.e. whether they can be called parts.*

A comparison with space will help here. What does it mean for an object (an ordinary chair) to be extended in *space*? It is not the case that the whole chair occupies every point of its spatial extension: at any one point of space all we find is a tiny portion of the chair (a bit of one leg, or a small part of the seat). The chair is spread across space, then, by having many tiny bits of itself occupying different points of space.

Now, as it happens a chair is generally made up of spatial parts in a strong sense (legs, seat, back). But some objects will not have parts like this. Imagine a huge amorphous blob, any one point of which is completely indistinguishable from any other. It would not be appropriate to talk of this blob having (strong) parts, despite the fact that it is spatially extended.

The comparison with space makes it clear that the minimal thesis - the claim that persisting objects are never wholly located at any one time - implies almost nothing about how (or if) these objects are divided up into parts, as long as "part" is understood in a reasonably strong sense. Just because an object is extended across time, it does not automatically follow that this object has (strong) temporal parts.

The minimal thesis is all that the someone accepting perdurance is committed to. Therefore if a person holds that objects perdure rather than endure, they do not need to also believe in temporal parts. So even if the

tenseless view is committed to perdurance rather than endurance, the implications of this are not very great. The problem for the tenseless view is only to explain why we think of objects as enduring, if in reality they perdure.

(vii) Problems with Temporal Parts

Although perdurance needn't imply temporal parts the usual way of understanding perdurance claims not only that objects have temporal parts, but also that these temporal parts are instantaneous time-slices designated by terms such as *A-at-t*.

What are the difficulties people have found with temporal parts? The most obvious problem with temporal parts as defined above is the conflict with our ordinary way of talking. It is true that we do talk about temporal parts, but this is only when we are talking about events and processes. Our ordinary concept of objects is that they possess spatial parts and endure through time. To talk of objects (as opposed to events) having temporal parts is unusual and straightforwardly conflicts with our notion of endurance.

I will return to this shortly. Firstly I want to look at some more formal problems that have been raised. One objection is given by Geach in his paper "Some Problems About Time". When I say that a chair is red, or that McTaggart believes in the unreality of time, what is the *subject* of "being-red" or "is a philosopher believing in the unreality of time"? If objects are composed of temporal parts, the subject will be a particular time-slice of the chair or McTaggart. Geach is unhappy with this. He argues that what is really red is the chair itself - the whole chair, not the chair-at-t; just as it is McTaggart himself who is a philosopher who believes in the unreality of time, not the temporal part *McTaggart-at-t*.

I think that a large part of this objection gains its force from the artificial nature of time-slices like *McTaggart-at-t*. A vivid way of seeing the artificial nature of a time-slice like *the-chair-at-t* is to compare temporal parts to spatial parts. Temporal parts are taken to be instantaneous time-slices like *A-at-t*. But nobody is likely to think that spatially extended objects are composed of an equivalent sort of "space-slice".

An instantaneous time-slice like *A-at-t* will usually still have a *spatial* extension. See the left hand side of figure 6.2). A space-slice will therefore be either a point of space extended in time (a space-point, *A-at-p*) or, allowing for the extra dimensions of space, a line extended in time (a space-line, *A-at-l*). See the right hand side of figure 6.2. But spatial parts are not usually

treated in this way. A chair is not thought to be spatially composed of elements like *chair-at-p*, or *chair-at-l*.

Spatial parts are not usually taken to be these kind of slices. "Parts" in this context are usually understood in the strong sense of "part". In other words parts of a chair include: several legs, a seat, and a back. Also, when we do talk about temporal parts more naturally (in the context of events and processes) these parts are again understood in the strong sense and not

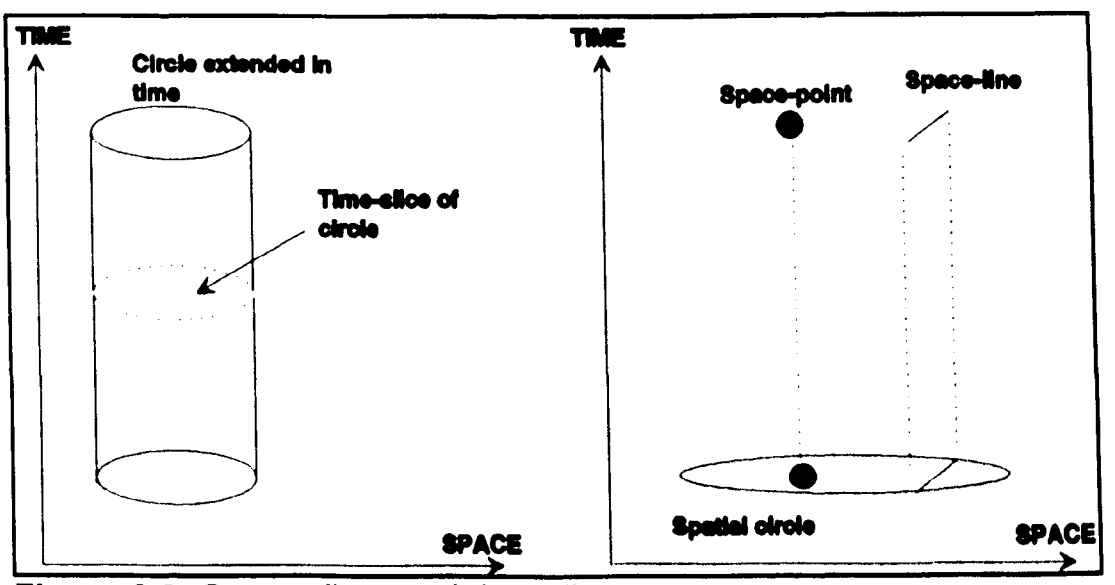

Figure 6.2 Space-slices and time-slices

taken to be instantaneous slices. A symphony falls naturally into three movements, the movements into phrases and notes: we do not take an arbitrary slice - *the-symphony-at-t* - and treat it as a temporal part of the symphony.

I cannot see anything wrong with letting both spatial parts of objects, and temporal parts of events be the subjects of a sentence. I can say "the chair leg is dented" or "the third movement of that symphony is fantastic". But I can understand why Geach might feel unhappy with terms like *McTaggart-at-t* appear in the subject position of a sentence. A similar feeling of unease would apply to a sentence like "*the-chair-at-place-p* is red", where "place p" is an unextended spatial point.

Why shouldn't temporal parts of an object be treated more like spatial parts of objects and temporal parts of events? Instead of a series of arbitrary time-slices, temporal parts could be regarded as clearly distinguishable stages. For example, the temporal parts of a butterfly fall naturally into the sequence: larvae, caterpillar, cocoon, butterfly. People, too, have natural temporal parts. For Jacques in Shakespeare's "As You Like It" people have

seven main parts, from an infant "mewling and puking in the nurse's arm" through to "second childishness, and mere oblivion, sans teeth, sans eyes, sans taste, sans everything".

Temporal parts of this sort can surely be a proper subject of a sentence. What is wrong in saying that *the child McTaggart* believed in reality of time, but that the *middle-aged McTaggart* believed time to be unreal? In a similar way it is customary to talk of the *early Wittgenstein* and the *later Wittgenstein*.

A different problem mentioned by Le Poidevin (see Le Poidevin [2], Chapter 4) is as follows. An object is supposed to be composed out of temporal parts. It might be expected that temporal parts are more "basic" than the objects constructed out of them. Temporal parts may be basic in an *ontological* sense, in that they are the elements out of which a temporally extended object is composed. But they are not conceptually basic. The concept of a temporally extended object is not defined in terms of temporal parts: rather we explain what a time-slice *A-at-t* is by saying that it is a slice of extended object A. This is implicit in the very way we talk about and define temporal parts as *A-at-t*. For example, if you ask me what I am talking about when I start mentioning "the table-at-t" I will explain that I mean an instantaneous time-slice of this (whole) table. So it seems that on a conceptual level extended objects are basic and the constituent temporal parts are abstractions.

The problem this is supposed to raise is based on the idea that since temporal parts are ontologically basic they should also be conceptually more basic. However, I can see little reason why anyone would want to or need to make this claim. We all accept that the material objects we see around us are composed out of atoms (and even smaller particles). Atoms are therefore ontologically more basic than things like chairs and tables. But this in no way entails that atoms are conceptually more basic in the sense that we can only build up a concept of "chair" or "table" if we have already acquired the concept of "atom". Similarly, a television is composed of a number of parts. Yet although most of us have the concept "television" very few of us know much about the parts out of which it is composed. There is no reason then that the ontologically priority of temporal parts entails that these parts should also have conceptual priority.

(viii) Objects and Events

What about the objection that temporal parts conflict with our ordinary ways of talking? I think that to some extent this conflict is reduced when temporal parts are conceived of in an appropriately strong sense. Although we never speak of objects having parts like *the-chair-at-t* or *McTaggart-at-t*, we do sometimes talk about *the-chair-before-it-was-painted-red* or *the-child-McTaggart*.

But while this may narrow the gap between temporal parts and our common way of talking, there is still a big divide. In our ordinary conception, objects and people don't have "parts": they are wholly present at each time of their existence and *endure* through time. What people do have is a *history*, which is essentially a long event or process. This history *can* be divided into temporal parts. When we talk of *the-chair-before-it-was-painted* and *the-child-McTaggart*, these names are most likely to be seen as shorthand for (respectively) the (whole) chair during those parts of its history that came before it was painted red and the (whole) McTaggart during those parts of his history in which he was a child.

Someone accepting the temporal part doctrine must simply accept that there is a conflict with our ordinary way of talking. The existence of temporal parts would require a revision in our commonsense conceptual framework. This is not too damaging in itself: commonsense is wrong about lots of things. But one particular reason why this revision of our ordinary conceptual scheme has been thought to be problematic is the belief that it destroys the distinction between objects and events. Since objects are spread out across time and made up of temporal parts, they differ very little from events: an "object" turns out to be just an extended event.

Most temporal part theorists (notably Quine) have simply accepted this and held that the tenseless view requires a revision of the distinction between objects and events. Someone might object that it is possible to conceive of an object which undergoes almost no change e.g. a diamond locked in a deep vault. How could this diamond be seen as a process if nothing ever happens to it? But there will always be some changes going on in the diamond from one moment to the next, even if these are subtle and minor ones (perhaps on

the atomic level). In this case the diamond can still be seen as a process, only a very boring one[30].

(ix) Why Do We Think Of Objects As Enduring?

I have tried to show that it is coherent and defensible to think of objects as perduring and having temporal parts. But there is one important question someone holding that objects perdure should offer an answer to: *why, if objects perdure (and have temporal parts), does our ordinary concept of objects regard them as wholly present at each given time and persisting through time by enduring?*

Note first that when we look at a chair or some other object, there is nothing in our experience to tell us whether we are looking at a temporal part or the whole object. Both theories result in the same experience at a given time. So our idea that objects endure has the status of a theory - not a direct perception. In what follows I will make some suggestions about why this theory is part of our common-sense understanding.

Suppose for the next few paragraphs that there are really temporal parts, and imagine a chair which has a reasonably long lifetime. At any time when we observe the chair certain features will be the same: its general shape, colour, design, etc, will remain constant. But other features will change from time to time: what room the chair is in, who is sitting in it, the new dent in one of the legs. Over a period of time it would not be surprising if we began to feel that on each occasion we were looking at the *very same chair* with perhaps only a few superficial and minor differences.

Another suggestion is based on a difference between the way we can observe objects in space, and the way we can observe them in time. Roughly, when I survey what is in front of me I can see *all at once* a large area of space and a large number of objects. The tree over there, the chair here, the clouds in the distance, all form part of the same visual field. But in time my observation is limited more or less to one particular moment. So from any particular location in time and space, I can survey objects occupying a large area of neighbouring space, but only objects occupying the same time.

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[30] Le Poidevin has argued that there is no need to completely blur the distinction between objects and events. He claims that even if objects have temporal parts there are some distinctions between objects and events. I will not look at his suggestions here, except to remark that they seem hard to make precise. All in all it is likely that the temporal part theorist will simply have to accept that there is no rigid distinction between objects on the one hand, and events and processes on the other.

How does this help to explain our idea of objects as enduring? Firstly, when I look at a chair I observe at once that it is composed of spatial parts (legs, seat, back, etc). I know this because I see all the parts in front of me, arranged to form a chair. In contrast I see only one temporal part of the chair. I may remember seeing the chair at earlier times, but this is not the same as directly seeing the various parts all together. Now this temporal part of the chair I see does not seem like a part in the way that one of the legs of the chair is a part. I can see that the leg isn't a whole complete chair, but only a component part. But the temporal part appears as complete in itself. It is solid, it can be sat on: what more does it take to be a chair? But supposing my (direct) observations were not limited in time in this way. Suppose that I could be directly aware of all the temporal parts of the chair from its manufacturer to its destruction. I think in these circumstances I would almost certainly think of the chair as *perduring*: it would be clear to me that it wasn't *enduring* since I could see all the parts laid out before me. But since at any one time my observation is strictly limited to that time, there is nothing to stop me thinking of the chair as enduring.

I think these two reasons - the constant nature of the chair contrasting with superficial changes, and the fact that at any moment only one temporal part can be seen - help to shed some light on why it is so natural to think of objects as enduring, even if in reality they perdure. Thus whether objects really endure or perdure, it is no wonder that our ordinary conception is that objects endure[31].

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[31] The discussion of temporal parts in this chapter is an example of a more general question concerning tenseless time. It is sometimes claimed that the tenseless view takes away from time one of the main features which distinguishes it from space i.e. *passage or flow*, and in effect makes time into little more than a form of space. This idea is part of the motivation for the doctrine of temporal parts: if time is only a sort of space, and objects have spatial parts, then shouldn't objects also have temporal parts?

As I have said, some people have thought that passage-less time must just be a sort of space. But the belief that the tenseless view makes time only a sort of space is one reason to doubt tenseless time. This is because there are many examples of very significant differences between time and space. These points raise two main questions: (1) how alike are space and time, and (2) can any genuine differences between time and space be accounted for if time is tenseless? For reasons of space I will not attempt to answer these questions here. Interested readers can find a full discussion in Appendix B.

Chapter Seven

Our Experience of Passage

(i) Introduction

In this chapter I will look at what appears to be the most serious problem with the tenseless theory of time[32]. This is that we almost constantly *experience* passage. In Donald William's words:

> It is simply that we *find* passage, that we are immediately and poignantly involved in the whoosh of process, the felt flow of one moment into the next. (See Williams [1], p.109)

Sitting alone quietly at night, listening to the steady ticking of a clock or the beating of your heart, you can almost feel time slipping past. But on the tenseless view it is incorrect to describe time as "slipping past": tenseless time is simply a "static" earlier than/later than ordering. Can this deep experience *as of* time's passing be accounted for if there is no genuine passage of time?

In this chapter I will try to offer a *tenseless* account of our sense of passage. Since our sense of passage is a complex phenomenon there is probably no satisfactory *single* type of explanation of its (tenseless) source. Rather it is a consequence of many factors which mix together to produce our final complicated sense *as of* time passing.

Over the course of this chapter I will suggest four main factors that are likely to be involved:

(1) Our (mis)use of language.

(2) The (large scale) phenomenology of our temporal experience.

(3) The (small scale) phenomenology of our temporal experience.

(4) The directedness or time-bias of knowledge, action, etc.

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[32] Another interesting, though less serious problem, is related to the *presence* of experience. This refers to the fact that all our current experiences appear to us as happening "now". How can we explain this "nowness" or "presentness" of experience if the current moment is not really "now" or "present"? For a discussion of this topic see Appendix C.

The most important of these factors are likely to be (2) and (3), to do with the *phenomenology* of our temporal experience. It is this area that I will be concerned with for the bulk of this chapter. But I will also include brief discussions of (1) and (4).

At the end of this chapter I will attempt to draw together the discussion of these factors and suggest how they can be used to offer a *combined* explanation of our sense of passage, which is much more plausible than the explanation offered in any single case. I will begin with some suggestions about the role the way we (mis)use language may play.

(ii) Our Sense of Passage - Linguistic Explanations

A variety of possible explanations of how (mis)use of language leads to our sense of passage have been put forward. One suggestion by Grünbaum (see Horwich [1], Chapter 2) is that we mistakenly treat "now" as a *noun*. We take the word "now" to denote a concrete entity, instead of simply a word used to pick out whatever time it is said at. Because this entity "now" is constantly occupying different times this leads us to the idea of the "now" *moving* from one time to another.

Another suggestion, mentioned by Smart, is that our idea of passage may in part result from "confusion about indexical expressions such as 'past', 'present', 'future', 'now' and tensed verbs" (Smart [1], p.86). He continues:

> If we forget the indexical character of the words 'past', 'present', and 'future' we may think that events really change in respect of being future and then present and then past. If a man says in his youth in 1755 'It is ten years since the '45 rebellion' and then in his old age in 1805 he says 'tis sixty years since' he may be tempted to think that there has been a real change of the '45, a recession into the past. (Smart [2], p.86)

The suggestion is that a particular event - in this case the '45 rebellion - is mistakenly treated in the same way as an ordinary object that can undergo change. The man in the above quote may forget that the sentence he says in his youth and the sentence he says in his old age both have an indexical element. When he says in 1755 that it is ten years since the '45 rebellion, what he says is made true by the fact that he is saying it in 1755. The truth of the sentence, uttered in 1805, "the rebellion is sixty years since" does not entail a change in the rebellion itself. It is simply that indexical

sentences vary their truth-values in different contexts. But if this is forgotten, *it may seem that the event has undergone a change of temporal properties (viz. presentness, futureness and pastness).*

By approaching things from a different angle and stressing the beliefs associated with tensed sentences, the linguistic explanation of our sense of passage can be improved greatly.

Tensed language will be linked with tensed beliefs, such as the belief that *it is now raining.* Mellor (Chapter 7, "Real Time") regards the changing truth-value of the tensed beliefs associated with tensed language as the main source of our sense of passage.

Suppose I have the belief that it is now one o' clock. This belief will vary in truth-value: it will be true if I hold it at one o'clock, and false otherwise. It will be true only briefly; the rest of the time it will be false. Mellor points out that ordinarily we try to make sure that the beliefs we have are true. When a belief is true we try to make sure that we have it; when it is false, we try to get rid it. Because of this, I will do my best to obtain the belief-token "it is now one o' clock" at one o' clock, and get rid of it immediately afterwards. In Mellor's opinion, these changing beliefs constitute:

> ... the psychological reality behind the myth of tense, the myth of the flow of time. The reality is the changing truth conditions of true token-reflexive beliefs; the myth results from mistaking these beliefs to have non-token-reflexive contents, and so to correspond to real movement along the A-Series, when in reality they do no such thing. (Mellor [1], p.116)

Passage as we usually conceive it has two main features. Firstly there is a real distinction between past, present and future. In particular the present or "now" has a privileged status. Secondly there is a constant change between these properties. If the change in our tensed beliefs is connected to this second aspect, then we can regard the special nature of our beliefs about what is happening now as connected to the first aspect.

Recall from Chapter Five that most of the information that comes into our senses will be conceptualised under the egocentric concept *nunc*; and that this concept is vital to action. Beliefs like *it is now raining* play a significant and distinctive role in our mental life. If we call beliefs like this *now-beliefs*, then these *now-beliefs* have a very special status in our thoughts, since they are directly linked to what we are perceiving (rather than what we are remembering or expecting). These beliefs are also what

galvanises us into action. It is not surprising, then, if we are tempted to transfer the privileged nature of these beliefs over onto a *metaphysical* "now".

These two points - the constant flux of our tensed beliefs, and the special nature of now-beliefs - mirror closely the dynamism and privileged nature of the "now" that characterise passage. It is quite likely, then, that these two factors play a role in producing our sense of passage.

I have now mentioned a variety of language-based explanations for our sense of passage. There may well be some truth in them. But there are several serious gaps. Firstly, although our ways of talking and thinking may *colour* our temporal experience to a degree, the feeling of passage is too pervasive and striking to be simply a result of some indexical confusion about language or belief.

Secondly, on the level of language and belief there are close analogies between time and space (i.e. between "now" and "here"). Why are we not misled into thinking that space passes? If Grünbaum's explanation is correct, why don't we treat "here" as a noun denoting a concrete entity? Since "here" is ever in different places, there is again an analogy with motion; yet we don't have a sense of a moving "here". Similarly Smart's man might say in different places that "the '45 rebellion was fifty miles away" and "the '45 rebellion was twenty miles away". But he will not be tempted to think of the '45 rebellion as somehow undergoing some real sort of spatial change involving real spatially tensed properties.

The same point applies to belief. A tensed belief is only a special case of whole range of *indexical* beliefs. These beliefs may be true at one time but false at another, true at one place but false at another, or true when held by one person but false when held by another. Examples are the belief *that it is now raining*, the belief *that the book is here*, or the belief *that I am hungry*. All these indexical beliefs are in a constant flux, yet no one is tempted to believe that space or people pass.

Facts about language and belief may play a role in our sense of passage, but this will be primarily a "support role". To find a deeper explanation it needs to be seen why we are tempted to forget about basic indexical rules in the case of time, but not in the case of space or people. The most obvious candidate for this deeper explanation is the peculiar nature of our experience of time. For this reason I will now look at the phenomenology of our temporal experience.

(iii) Two Levels of Temporal Experience

Before exploring how the phenomenology of our experience may give rise to our sense of passage I want to look more generally at our experience of things in time. In particular, I want to look at what is involved in perceiving a process or sequence of events, such as listening to a piece of music. There are perhaps three basic puzzles about how we experience processes.

Firstly, how do we actually experience a process *as a process* i.e. as an event made up of other events and strung out through time? Consider the following argument. If I am listening to a melody, I don't hear the whole melody at once, but rather phrase after phrase, note after note. At any one moment I can only be hearing one particular note. Worse than this, I can only be hearing part of a particular note: the small part of the note which is sounding at that very moment. Taking this to its extreme conclusion, at any moment I am only hearing an instantaneous part of a note. How do I experience the notes as lasting for a certain time, and the total melody *as* a melody made up of these notes, when all I ever hear at any given time is the part of the note sounding at that time?

Secondly, there is a puzzle about my awareness of my own acts of perception as processes. For example, when hearing a melody I am not only aware of the melody as a continuing piece of music, but also of my own ongoing act of hearing it.

Thirdly, as I listen, I am aware that more and more of the music has "gone past" or already been heard, and that less and less of the music is "still to come" or yet to be heard. In other words, my *temporal perspective* with regard to the music has changed. What makes this possible? This question is central to this chapter. It is simply the problem of our sense of passage: the fact that some events seem to be yet-to-come, others to be "now", and others as already-gone.

Before discussing these problems it is worthwhile making a distinction between *large scale* temporal experience and *small scale* temporal experience. By "large scale" I mean the commonsense way we make sense of our experience in terms of what we are presently experiencing, what we remember and what we expect to happen. In contrast to this *small scale temporal experience* is a focus on the (large scale) category of what we are

presently experiencing. As we shall see, this "present experience" is not a simple thing.

A graphic way to illustrate the difference between these two levels of experience is given by Broad when he points out the difference between directly seeing that the second hand of a clock *is moving*, and seeing that the hour hand of the clock *has moved*. In the case of the hour hand, we see where the hand is and recollect that at an earlier time it was in a different position. We therefore conclude that it *has moved*. But the movement of the second hand is somehow apprehended in one act of consciousness. We see that it *is moving*. As Lockwood puts it:

> It seems to be a brute fact about experience that events which are contained within a sufficiently small interval can be experienced as a group, encompassed within a single phenomenal perspective, without thereby being experienced as simultaneous. (Lockwood [1], p.263)

There are no easy answers to many of the problems concerning our temporal experience. Most of the difficulties, however, come about when we consider temporal experience *on the small scale*. Before getting into these thorny issues, I will offer a preliminary sketch of how our sense of passage might arise in terms of *large-scale* temporal experience. This sketch will hopefully be less controversial than matters to do with the small-scale; and I think it will be apparent when I have sketched the account that even by itself it can provide an explanation of *some* features of our sense of passage.

But there will be other features of our sense of passage left unexplained. Just as the most severe difficulties with understanding our temporal experience arise on the small scale, so it is also on the small scale that the most important issues have to be settled. To find a full account of our sense of passage it will therefore be necessary to make some attempt to examine our small-scale temporal experience.

(iv) Our Sense of Passage - A (Large-Scale) Sketch

What follows is only a preliminary sketch. The account is not necessarily correct in every detail; the aim is to give an idea of how our sense of passage *could* be explained on a tenseless view of time.The best way to treat it is as an attempt to tell a plausible *story* of how this sense might arise (on the large scale).

The first point to make is that there is a distinction between a *succession of experiences* and an *experience of succession*. The mere fact that a succession of experiences pass through someone's mind does not guarantee that these experiences will be felt to follow each other. Imagine someone going through life with their consciousness strictly limited to whatever they happen to be presently experiencing. Suppose that this is all that their experience consists of - there are no memories of earlier stages of their life, and no expectations about what might be happening the next day or week. In this person's mind there would clearly be a succession of different experiences, but equally clearly they could not experience this succession *as a succession*. Their consciousness would be like a "string of bead-like sensations and images, all separate" (see James [1], p.605).

It is because of this distinction that the first puzzle with temporal experience I mentioned arises. There is no difficulty with a succession of experiences passing through someone's consciousness; the difficulty is how this succession is experienced for what it is i.e. a continuous process or a sequence of events. In other words, what links the multitude of experiences passing through consciousness together, so that they do not appear as separate "beads"?

To link these bead-like experiences, a common option is to suppose that in some sense earlier and later experiences are "co-present" in consciousness. In this (large-scale) context, this "co-presentness" amounts to the fact that earlier and later experiences appear in consciousness in the form of *memories* and *expectations*.

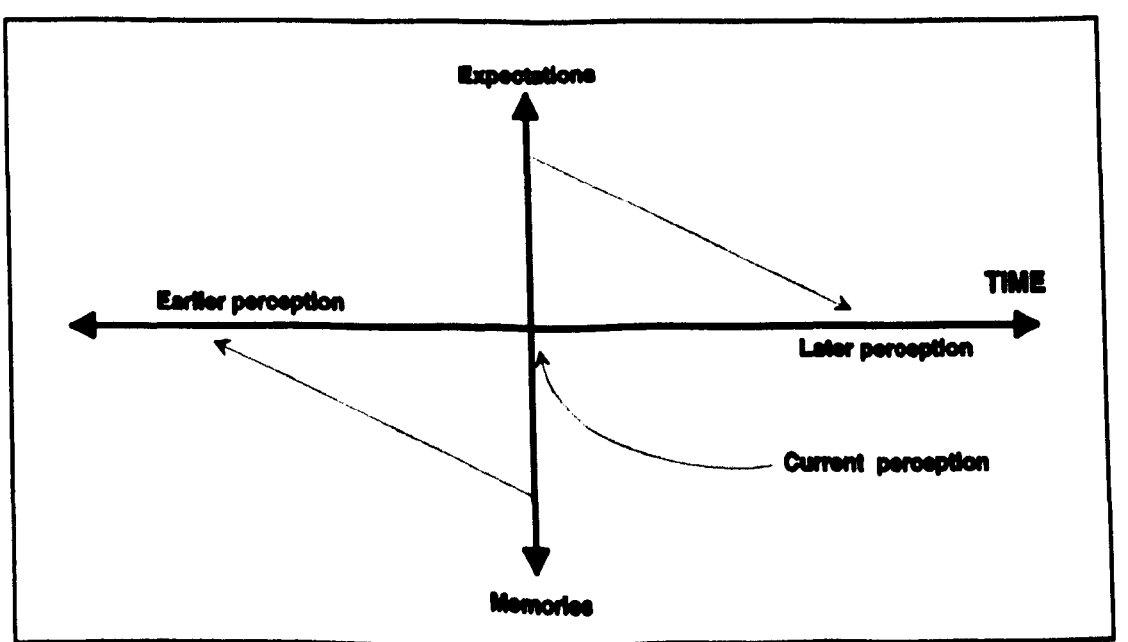

Figure 7.1. Husserl's idea of a horizon

Two concepts borrowed (loosely) from Husserl will help make this clearer (see Miller [1] for further details). Firstly there is the notion of the *horizon* associated with any given experience. Imagine you are standing before a tree. Then imagine walking slowly around the tree, looking at it from different angles, until you reach the other side. When looking at the tree from the other side there will be three main components of your experience: a present perception of the tree as it looks from that side, memories of how the tree looked from various other angles , and expectations of what sort of perceptions you would have if you continued to walk around the tree[33]. This pattern of expectations and memories associated with a given present perception is the *horizon* of that perception.

This notion of *horizon* is illustrated in figure 7.1. In the figure the horizontal axis represents the time during which you are walking around the tree. Each point of the time-axis corresponds to a particular perception of the tree. Associated with each perception is a set of expectations (represented on the upper vertical line). Each expectation has as its object a later perception (i.e. the content of the expectation is *what you will expect to see*). There is also a set of memories (represented on the lower vertical line). Again each memory has as its object an earlier perception (the memory is of *what you saw*). The set of expectations together with the set of memories together form the *horizon* of that particular perception.

In broad outline this notion explains our (large-scale) perception of processes *as processes*. No experience is "bead-like" but is intermingled with memories and expectations, allowing us to relate the present experience to what has gone before and what will come after, to see it as occurring in a definite sequence. If I am listening to a symphony, for example, then while I am hearing the second movement, I will remember something about what the first movement was like and will have some expectation (however vague) of what the third movement will be like. Having these three elements in my mind "at once" enables me to hear the symphony as one extended process.

The second notion I will borrow from Husserl is that of *double intentionality*. The idea is that not only is a given memory a memory of an earlier perception: it is also a memory *of the horizon of memories and expectations associated with the remembered perception*. Imagine a person called Bill, who is enjoying a quiet pint of beer, with a pleasant memory of

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[33] It is clear that these expectations generally do exist. Imagine walking further around the tree and finding that, in the part of the tree you haven't seen yet, great wads of fifty pound notes are growing on the branches instead of leaves. This would be a shock because seeing a lot of fifty pound notes is not the expected perception!

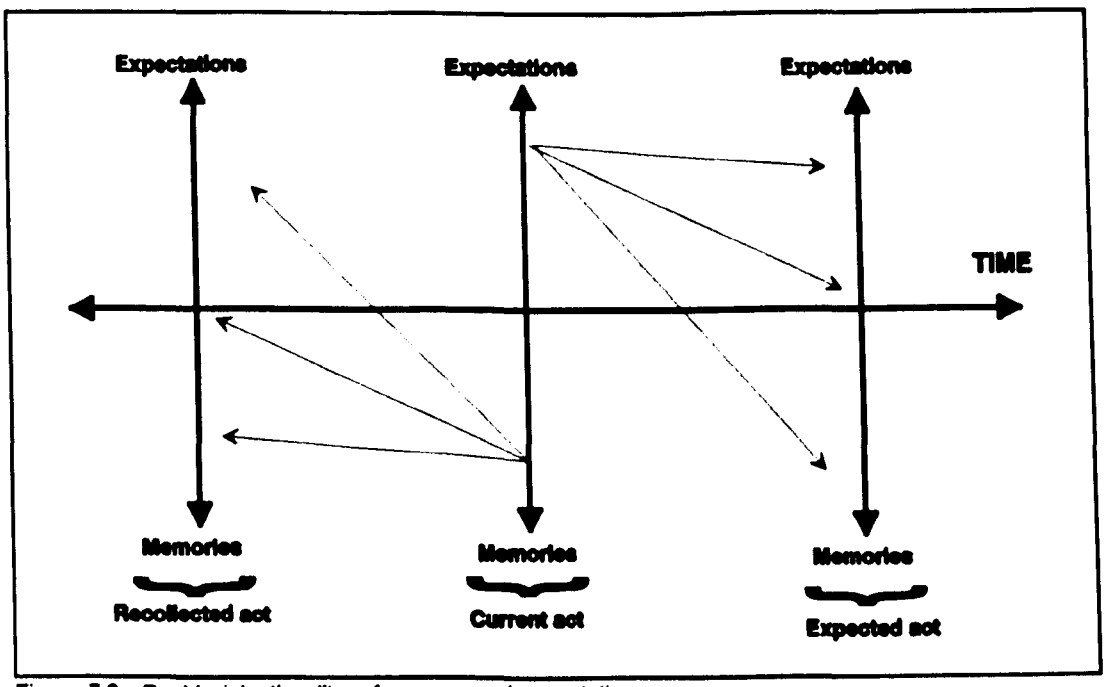

Figure 7.2. Double intentionality of memory and expectation

having just passed an exam, and a pleasant expectation of having a good evening out. When the next morning comes, Bill may be having the unpleasant experience of a hangover. But he will also have a set of memories. He remembers passing an exam. He remembers having a quiet pint of beer. Along with his memory of having the pint of beer he will remember other factors associated with his simple experience of drinking. In particular he will remember that, while drinking, he had a memory of passing an exam - to put it a bit awkwardly, he has a memory of a memory. Likewise, he has a memory of an expectation - he remembers that while he was drinking his pint he had the pleasant expectation of having a good night out. Husserl calls this *double* intentionality since Bill's memory of drinking his pint is in the first place directed simply towards the experience of drinking, but in the second place directed towards the whole act of awareness associated with the drinking (in particular the associated horizon of memories and expectations). This idea is illustrated in figure 7.2.

This gives an outline of how we perceive our own acts of awareness *as processes*. Returning to what happens when I am listening to a symphony: during the second movement I have a memory of the first movement, but along with this memory I also recollect other contents of my consciousness associated with the first movement (my act of listening to it, my moods, my memories and expectations). Because of this my listening is perceived by me as a process itself, as something forming part of my *stream*

of consciousness, earlier than some parts, later than others, and having its own place in the overall sequence.

Coming finally to the key puzzle about how to account for our changing temporal perspective, an important point is that certain features of a person's mental life remain fairly constant through a diversity of experiences. During a particular week I may have a variety of experiences; constant during most of these experiences will be basic character traits, habits, the feeling of *what it is like* to be me. I will remember that at earlier times I also had a similar feeling about what it was like to be me; and I will expect to feel the same way at later times.

These two factors - a variety of experience and a constant sense of *what it is like* to be me - can lead to the sense of a constant "me" persisting through time and undergoing different experiences and events.

Reinforcing this idea of a constant "me" persisting through time is that at each moment the self has a feeling of *completeness*. This can be seen by the following thought-experiment. Imagine that you were created only a moment ago and will be destroyed a moment hence. During this brief moment of existence you have all the (large-scale) memories and expectations that you would have had if you had existed properly. Despite having no future or past, you will still feel a complete person for that brief instant. And since at each moment *the self feels complete*, this "me" will tend to regard itself as being *wholly present* at each time. In other words, recalling the discussion of Chapter Six, we will feel that we *endure* through time. I do not want to complicate the discussion by reviving the perdurance-endurance debate. Since we are discussing our temporal experience, not the underlying metaphysics, the important point in the present context is simply that *there is a feeling of constancy over time and completeness at a time*. Whatever the underlying explanation of these feelings (whether they are based on endurance or perdurance), the fact is that we do have them.

We can now add the final, key point of my (large-scale) explanation of our sense of passage. As I have argued, at any moment it will seem to a person that they are wholly present at a particular position within a process e.g. listening-to-the-second-movement-of-a-symphony-having-heard-the-first-movement-and-expecting-the-third. But it will also seem to them (via the medium of memory) that the self now hearing the second movement was wholly present at a different position within the process e.g. listening-to-the-first-movement-and-expecting-the-second-and-third-movements.

Although all this is quite compatible with a tenseless view, there is a strong tendency to interpret these facts in terms of the very same self *progressing* or *moving* through the perceived process. When I discussed endurance in Chapter Six, it was only by thinking carefully about how we use the words "whole" and "part" that we found a way to conceive of endurance in such a way that no illegitimate "motion" through time was involved. Given this, it is highly likely that these features of our experience make us feel that we are progressing or moving through time. In other words, we will have a sense of passage.

Overall there are five main elements in this explanation. The five elements are:

(1) We are able to perceive processes as processes, because of the "co-presence" in our experience of present perceptions, memories and expectations.

(2) We are able to perceive our own acts of perception and awareness as continuous processes because these memories and expectations are doubly intentional - memories for instance refer back not only to past perceptions but also to the whole act of awareness associated with that perception.

(3) Because of this double intentionality we become aware that at each time of our conscious lives there are certain constant factors viz. a general feeling of *what it is to be like* the person we are. We are also aware that contrasting with this constancy is a wide diversity of *contents of experience* at different times.

(4) The *completeness* associated with the self at any instant, together with the constant feeling of what it is to be like a particular person, leads to the feeling of a the very same self wholly existing at a number of different times.

(5) If the constant self is felt to be wholly present at each time, and if there is a diversity of contents/experience in that self's consciousness, the situation is naturally understood as a self progressing through time[34].

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[34] Rather than the feeling of progressing into the future, a person might feel that they themselves are static and that events flow towards them from the future. Which seems more natural to someone is perhaps a matter of temperament. The five elements behind our sense of passage are the same in both cases: the key idea is that there is a perception of a complete person *in relative motion* with respect to an array of events.

(v) What is Wrong With This Account?

There are several problems in the sketch I have outlined above. One problem is simply that it bypasses many issues. This is because our large-scale temporal experience is to a degree *built out of* a sequence of small-scale temporal experiences.

Secondly, it can be plausibly argued that even if (large-scale) memory and expectation were absent in a particular person they would still have a sense of passage. To quote William James:

> the reproduction of an event, *after* it has once completely dropped out of the rearward end of the specious present, is an entirely different psychic fact from its direct perception in the specious present as a thing immediately past. A creature might be entirely devoid of *reproductive* memory, and yet have the time-sense; but the latter would be limited, in his case, to the few seconds immediately passing by ... (James [1], p.630-631)

A third problem is that some of the deepest and most vivid experiences of time passing are to be found on the small-scale. Time's passage is most nearly "grasped" in small-scale experiences like watching the second hand of a clock or listening to one's heart beating. Paraphrasing Broad, on the small-scale we can almost watch time *passing*, rather than realizing that (while we weren't looking) time *has passed*.

For these three reasons, then, it will be necessary to look at our temporal experience.

(vi) Small-scale Temporal Experience

Small-scale temporal experience is a focus on the large scale category of what we are presently experiencing. That is, it is a focus on what goes on in consciousness during a span of a few seconds. When I watch the second hand of a clock moving, or listen to the first few notes of the C Major Scale (Do-Re-Mi-Fa-So), or hear someone saying some sentence to me, then in the large-scale sense this is what I am presently experiencing, and there is nothing else to be said. But it will become apparent that this "present experience" is full of complexities and riddles.

The first point here is the same that began the large-scale discussion: a succession of experiences is not the same as an experience of succession. A succession of experiences may be a necessary condition of an experience of succession, but it is by no means sufficient. Once again this means that while I am experiencing a particular note (or part of a note), earlier notes (or earlier parts of the given note) must in some sense be *co-present* with this experience within my consciousness.

As a vivid way of illustrating this, consider what is happening in consciousness when a person says the sentence "the pack of cards is on the table" (see James [1] pp.279-283). James writes that when we are uttering a sentence:

> [the whole of the sentence] may be and usually is present not only before and after the phrase has been spoken, but also whilst each separate word is uttered. It is the overtone, halo, or fringe of the word, *as spoken in that sentence*. (James [1], p.281)

Just as the sentence is starting to be said, the speaker will in some sense have the whole sentence in their consciousness, since they know what they are intending to say. When uttering the word "cards" the whole sentence will again be in consciousness, part of it as *what has so far been said*, part of it as *what is still left to be said*. The word currently being spoken will no doubt be the most striking or vivid part of the sentence in consciousness - the rest of the sentence (as James says) forms a halo or fringe.

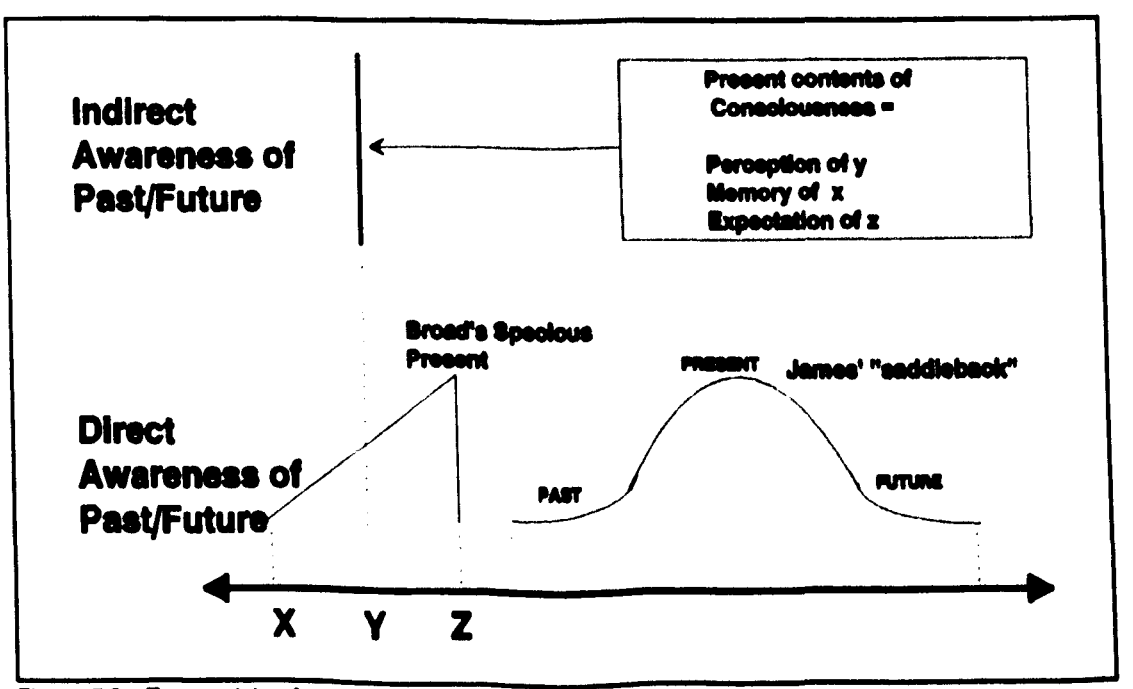

Figure 7.3. Two models of temporal experience

As a description of our experience the above seems correct. But although there may be agreement that consciousness must contain more at any one time than just what is immediately present, exactly what this involves is controversial. Different theories fall into two main groups.

Firstly it might be thought that our awareness is not confined to a strictly punctal present, but can *directly* perceive events over a short neighbouring span of time. In most cases this span is regarded as a short period *earlier* than the present experience. Suppose that I am listening to someone practising part of the C Major scale on the piano: Do, Re, Mi, Fa, So. When I hear a note playing, on this view, immediately earlier notes are still objects of my direct perception. When I am listening to *Mi*, I am still directly aware of *Do* and *Re*.

C.D.Broad, who at one stage in his career defended a version of this approach limited this direct perception solely to a short span of earlier/past times. Admitting later/future events into direct awareness has been thought to be more problematic, but William James, for example, talks of a "saddle-back", extending a little way into *both* the past and the future. Both options are shown in the lower part of figure 7.3. Whichever is true, the key idea is that I can experience the music as a process because at any one time *I am directly aware of notes other than the note (or part of a note) sounding at that time*.

Secondly one might say that awareness is confined to a punctal present, but *indirectly* includes details about earlier and later events. The most obvious example here is to say that along with an immediate perception, we have a sequence of vivid short-term memories (and expectations). When I am hearing *Mi*, I have a short-term memory of hearing *Re* (and an expectation of hearing *Fa*). This model is shown in the top part of figure 7.3. This way of looking at things is clearly analogous to the three-fold structure of memory, present experience, and expectations that is found in large-scale temporal experience. The point is that I am not *directly* aware, while hearing *Mi*, of any other note. Rather earlier and later notes appear in my consciousness in the form of vivid short-term memories and expectations.

Over the next few sections I will look at worked-out examples of both these approaches. Firstly I will look at an account which assumes that awareness is confined to a single instant: this is Edmund Husserl's account of our temporal experience. Secondly I will look at some accounts which assume we can directly perceive events over a short period of time: these are

Broad's specious present account, and the temporal overlap model suggested by people like Foster and Lockwood.

(vii) Husserl on Temporal Awareness

To go into all the details of Husserl's account of our experience of time would be a lengthy process. In what follows I will give a brief precis, picking out the most relevant ideas, and ending with some problems. The details of this account are derived from an excellent book on Husserl by I.Miller (see Miller [1]).

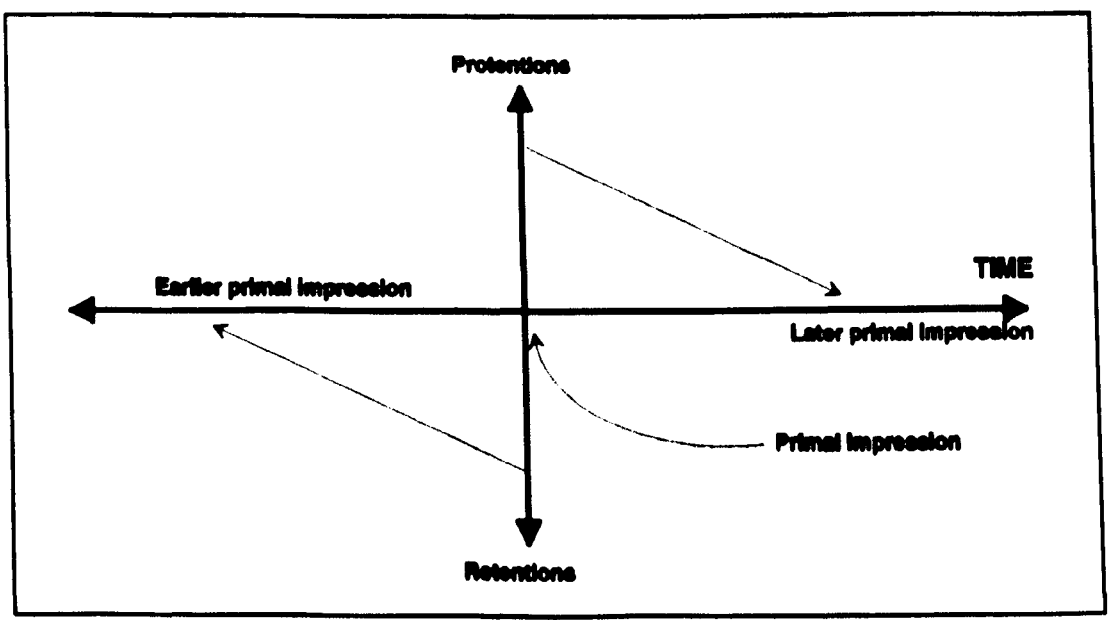

Figure 7.4. Retentions and protentions

When I perceive a note, Husserl says, I have a continuous perception lasting as long as the note, but at each instant that act of perception has a complex structure. There are three main parts to this structure: a *primal impression*, a *continuous manifold of retentions*, and a *continuous manifold of protentions*. The primal impression is perception of the instantaneous part of the note sounding at that moment and is experienced as *sounding-now*. This primal impression gives rise to a continuous, fading, sequence of retentions. A retention is something like a very vivid memory that lasts only a short time after the initial experience, gradually becoming less vivid until vanishing altogether. Finally there is a manifold of protentions, like short-term expectations of immediately later note-parts.

This is shown in figure 7.4. The horizontal line represents a sequence of primal impressions. The vertical lines represent the pattern of retentions and protentions associated with each primal impression. The current primal

impression is in the middle of the diagram. Retentions on the lower part of the vertical line refer back to earlier primal impressions; protention on the upper part of the vertical line refer forwards to later (expected) primal impressions.

This helps to explain our perception of processes *as* processes on the small scale, and in particular our perception of a single note as persisting for a certain time. When I am hearing the middle part of the note I will have "co-present" in my consciousness retentions of earlier parts of the note and protentions of later parts of the note. This allows me to hear the note as a continuous whole.

To account for how we are aware of our own acts of perception, Husserl invokes the idea (already mentioned) of *double intentionality*. As Miller says:

> What I retain through a retention is not just the "content" of an earlier primal-impression but the "content" of an earlier whole act-phase ... (Miller [1], p.148)

A retention is not only a retention of the content of the primal impression but of all that went along with that phase of the act at the time of the primal impression i.e. the type of the act, its object, the pattern of retentions and protentions that form part of the act's structure, etc.

This is shown in figure 7.5. In the diagram the retentions and protentions on the middle vertical line refer not only to earlier and later primal impressions but also to the pattern of retentions and protentions associated with those primal impressions. Thus at any stage of my act of listening I will have retentions of earlier parts of my act and protentions of later parts of my act, which allows me to be aware of my act of listening as continuing and lasting through time.

So far the account closely follows the large-scale account I gave. But on the small-scale some difficult problems arise. One problem is simply the *sheer complexity* of the account. At any one instant I not only have a "primal impression" of the part of the note then sounding, but also a set of retentions and protentions of preceding and following primal impressions. And these retentions and protentions are directed not just at earlier and later primal impressions but also to the associated patterns of retentions and protentions associated with those impressions. *But since each primal impression is instantaneous there will be an infinite amount contained in any finite slice of time*. This means that associated with each primal impression must be an

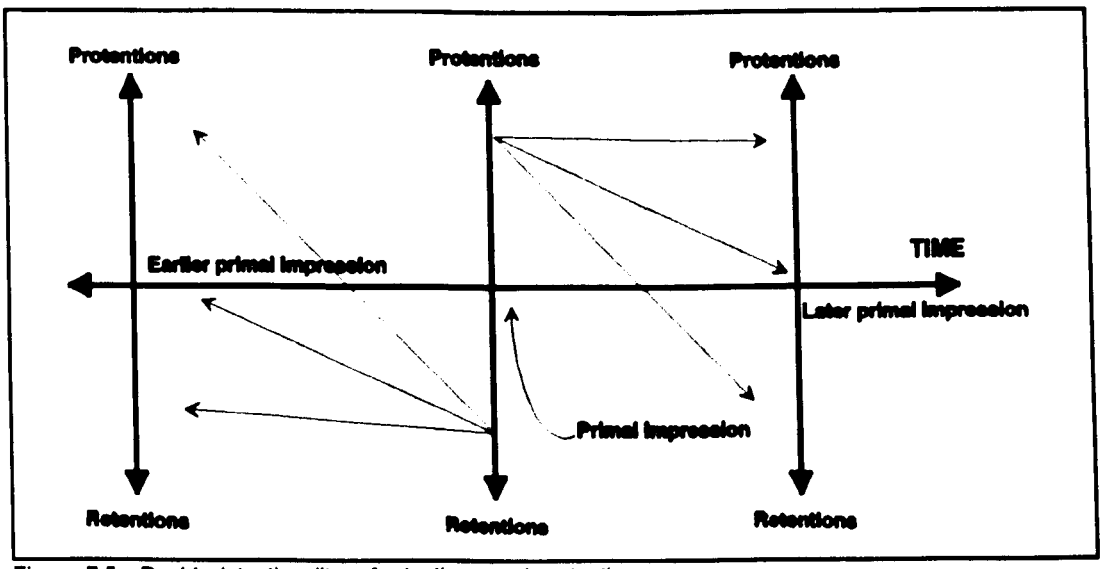

Figure 7.5. Double intentionality of retentions and protentions

infinite set of retentions and protentions, one for each earlier and later primal impression within a certain span. So each of my infinite number of retentions and protentions of various primal impressions are also retentions and protentions of the infinite number of retentions and protentions associated with these primal impressions. The whole setup is a staggering complex. Is our consciousness really like this?

Aside from the complexity involved, it is not clear how we come by all these retentions and protentions. Retentions and protentions are said to be intentional. This would mean that each retention/protention has as its intentional object (i.e is directed towards) an instantaneous note-part. Miller argues that this cannot be so. It would mean that every instantaneous note-part making up the whole note would have to be *individuated* by us in order for our retentions and protentions to have them as their object. To have a retention of a past part of a note I need to have somehow singled out/perceived that part of the note by itself. But it is not clear if we are capable of doing this. Certainly, on a conscious level, the note comes to us *as a whole*. We may roughly distinguish between its beginning and end, but the experience is not (infinitely) fine-grained in the way Husserl's account suggests.

Miller tries to answer this point by arguing that we do not need to individuate every primal impression. Aside from solving the problem of individuation, if this were true it would go a long way to reducing the sheer complexity of the account, since there would no longer be an infinite number of individuated primal impressions with all their associated retentions and

protentions. Miller develops this answer in terms of Husserl's notion of *constitution*. To constitute an object means that:

> in the act the various components of consciousness are interconnected in such a way that we have an experience as of one full-fledged object' (Miller, quoting Follesdal, p.140)

This *constitution* is a very difficult idea to grasp. The nearest I can get to understanding it is that various features of consciousness combine in such a way that I "fill in the gaps" in my experience of the note. I need not individuate every note-part: instead I may individuate only a few and fill in the rest in such a way as to have an experience *as of* a continuous sounding note. I am not sure however if this understanding is correct. In any case it seems to me that *constitution* as defined above is unlikely to be very helpful: surely the very question under consideration is just *how* the various components of consciousness are interconnected so as to give us an experience of one temporally-extended full-fledged object?

Since Husserl's account seems to be running into difficulties I will now turn to the alternative way of looking at things i.e. in which consciousness is assumed to directly perceive all the events contained within a short period of time.

(viii) Broad's Specious Present

A classic (though problem-ridden) version of this approach is presented by C.D.Broad in "Scientific Thought", Part II, Chapter X. See also J.D.Mabbott's "Our Direct Experience of Time". The central idea is that as well as being aware of present events our direct awareness extends into the past. Associated with each act of awareness is a "specious present", perhaps 6-12 seconds long[35]. In figure 7.6 (see Mabbott [1], from whom I take the diagram) acts of awareness are represented on the upper line ABC; the contents (objects) of that awareness are represented on the lower line VWXYZ. A momentary act of awareness A will include not just the present experience X but all the experiences stretching back from X as far as V.

But acts of awareness will not in general be momentary. When I listen to the sequence *Do-Re-Mi-Fa-So*, I have an act of awareness lasting the

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[35] Estimates of the minimum and maximum length of the specious present vary considerably - I will discuss this later in the section.

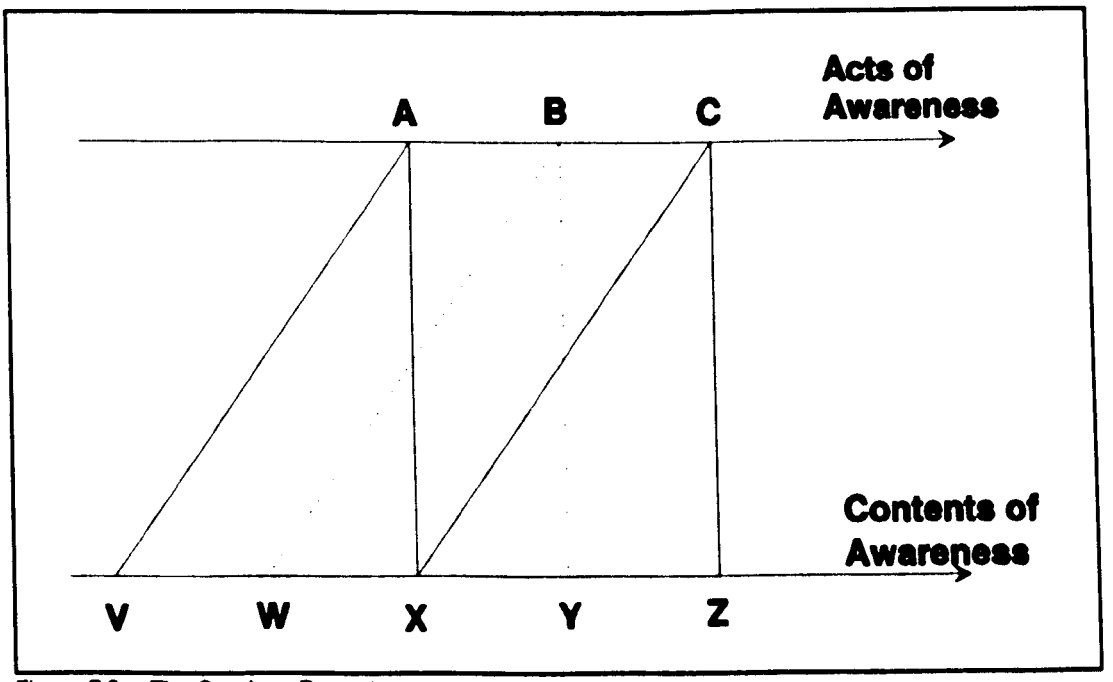

Figure 7.6. The Specious Present

whole duration of the sequence (say about 3 seconds). This act of awareness will be composed of a multitude of momentary acts, but nevertheless has an identity of its own.

Suppose that an act of awareness lasts from A to B (in the diagram). Broad asks the question: what is the specious present of this act? He answers that it must be the interval WX *which is common to all momentary acts of awareness between A and B*. As Broad writes:

> The longer an event the shorter is the process of sensing throughout the whole of which it is present. As the length of the sensed event approaches that of the Specious Present, the duration of the process of sensing throughout the whole of which the event is present approaches to nothing. (Broad [1], p.350)

This means that the duration of the specious present varies inversely with respect to the duration of the act of awareness involved. If a momentary act of awareness has a span of six seconds, an act lasting two seconds will have a span of four seconds, an act lasting three seconds will have a span of three seconds, and so on.

This is the bare bones of Broad's theory. It offers an explanation of how we perceive (small-scale) processes by saying that we can directly perceive them *all at once*, in a single specious present. And although Broad does not consider our consciousness of the continuous process of our own perceptions and streams of consciousness, an answer is not hard to find.

Within a particular specious present we not only directly perceive *external* events over a short span of time, but also *internal events*. Thus in some sense we are directly aware of our recent acts of awareness i.e. immediately past specious presents are comprehended in the current specious present.

What problems are there with this account? Firstly it is a consequence of Broad's analysis that almost all our so-called "present" experience is actually *of the past*. When I apprehend a note in the specious present only the very last part of the note is strictly present (i.e. occurs at the same time as my act of awareness). If the note lasts from V to X and I apprehend the note in the momentary act of awareness A, only the last part of the note (occurring at X) is contemporary with A. This seems a little counterintuitive, but the only alternative would be something like James' saddle-back. The problem with the saddle-back picture is that it would give us direct awareness of the immediate future. For Broad, holding an A-Series view of time, this is unacceptable; though perhaps for the tenseless view it is less problematic.

Secondly, and most seriously, there is a problem of *overlapping* specious presents. The specious presents corresponding to the momentary acts of awareness A and B overlap in the region between W and X. Suppose that a brief sound S occurs between W and X. Then as Mabbott says:

> I shall experience [S] ... as part of the specious present VX ... I shall experience it again as part of the specious present WY. Every brief sound I hear I shall experience not once but repeatedly. Nothing in my direct experience confirms this repetition. If it occurred it would obviously make listening to music or to continuous sentences a matter of the greatest complexity and difficulty. (Mabbott [1], p.161)

Clearly there is nothing in our experience to suggest that we repeatedly experience the same things. When I listen to the sequence *Do-Re-Mi-Fa-So*, I do not seem to hear *Do* when it first sounds, then again while I am hearing *Re*, and then again while I am hearing *Mi*.

One way to avoid this problem is to suppose that there are long gaps between acts of awareness. If there were no acts of awareness between A and C there would be no repetition. We would have one act of awareness which encompasses a six second span stretching back into the past; then our minds would be quiet for six seconds; then we would have another act of awareness. It is true that if these acts merged neatly with one another we might not be aware of the "gappiness"; but this seems even more bizarre than the idea that my experiences are repeated many times.

A third problem concerns the length of the specious present. Does it have a fixed duration? If so, what is it? If not, what are the minimum and maximum durations? The original impetus for the idea of the specious present came from two main groups of experiments carried out towards the end of the nineteenth century. One set of experiments tried to find out the largest group of sounds that could apparently be grasped and remembered as a whole. In other experiments people were asked to estimate (without clocks) when a particular duration of time had elapsed. The aim was to find that interval of time which people tended to estimate most correctly[36]. In the first set of experiments the duration taken up by the largest group of sounds was found by some experimenters to be about 6 seconds; by others 12 seconds; and by others 36 seconds[37]. In the second set the interval was found to be about 0.75 seconds, though again results varied with different experimenters. This interval has also since been found to vary considerably from person to person.

All in all it could not be said that these experiments are definite enough to support the idea of the specious present. Even if a particular set of results had been agreed on it is still not clear what they should be taken to show. This suggests that there is no easy way to explore the *particular facts* (as opposed to the *general theory*) of the specious present. Mabbot notes that there have been few experiments since these earlier ones. He writes:

> It is interesting and, I think, significant that psychologists, ever since the original work ... have tended to neglect the specious present ... Was this due to the fact that the notion had not been so clarified as to be a possible basis for future experiment? Or was it perhaps that the notion cannot be so clarified? (Mabbott, p.164)

Broad's account of our small-scale temporal experience, then, is riddled with problems. Of these the repetition problem appears to be the most serious. In the next section I will examine an improved version of the temporal overlap model, which aims to meet this problem.

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[36] Called *indifference points*.

[37] Often quoted in discussions of this topic is the example of Mozart who claimed to be able to grasp a whole symphony all at once, as if heard all together. This kind of example suggests that the experiment is flawed as an attempt to find the duration of the specious present, since surely direct perception could not extend over the twenty or thirty minutes of a symphony.

(ix) The Temporal Overlap Model

The temporal overlap model shares with Broad the idea that we can directly apprehend events over a short period of time. The key to understanding how the temporal overlap model differs from Broad's account is to examine its response to the problem of repetition.

Using the familiar example of *Do-Re-Mi-Fa-So* again, the problem of repetition is that I will apparently repeatedly hear *Do* in every act of awareness that takes place within a few seconds of the act in which I first hear it. I experience it once, then I experience it again, then I experience it again. Roughly, the solution put forward by people like Foster and Lockwood is that my first experience of *Do* is not distinct from any of my latter experiences of *Do*: *these experiences are numerically identical.*

In other words, successive specious presents do not just *overlap* with regard to the events they encompass (e.g. the note *Do*), they also *overlap* with regard to phenomenal content (e.g. the experience of the note *Do*). Foster expresses this point in the following quote (by "temporal patterns" he means the sequence of events being experienced, and by "total presentations" he means the experiential content of a given specious present):

> ... where the temporal patterns presented by successive total presentations overlap in quality, in that some last portion of the first is the same as some first portion of the second [i.e. there is a repetition], the two total presentations overlap in a corresponding way, in that the component presentations which in their respective totals present this common sub-pattern are themselves numerically identical ... (Foster [1], p.176)

This suggestion appears to solve the problem of repetition which was the most serious flaw in Broad's account. Although the note *Do* will form part of the content of various specious presents, the experience of this note in one specious present is numerically identical with the experience of the note in another specious present.

But this solution raises a new difficulty. Lockwood, particularly, emphasises that when we hear *Do* we experience it "sinking into the past". In the first specious present in which *Do* appears, it appears as fresh and fully present. In later specious presents it appears respectively as *just past*,

further past, *still further past*, and so on. This is apparently a feature of our experience. Imagine hearing the notes *Do-Re-Mi-So-Fa*. While hearing *Re*, *Do* is still part of one's consciousness, but appears to be slightly past in comparison with *Re*.

The puzzle is how this can be accounted for if the experiences of *Do* in successive specious presents are actually the very same experience. How can the very same experience of *Do* present the note in one case as present and in another case as just past? The conclusion seems to be that *Do* is experienced differently in each case i.e. numerically distinct experiences are involved.

One possible response is to argue that the difference in the experience of *Do* in successive specious presents is not an intrinsic difference in the experience itself, but a *relational difference*.

Each specious present contains an array of experiences. One specious present, for example, might contain the experiences [silence, silence, *Do*]. The next might contain [silence, *Do*, *Re*]. The next might contain [*Do*, *Re*, *Mi*]. According to the temporal overlap model the experiences of *Do* appearing in these specious presents are numerically identical. But according to many people our experience is such that *Do* appears as present in the first specious present, as just past in the next, and as further past in the next. A solution to this difficulty is to suggest that the apparent difference is a result of which place *Do* occupies in a given specious present.

When first heard *Do* is part of the specious present [silence, silence, *Do*]. That is, it is at the front end of the specious present. The suggestion is that the property the experience of *Do* appears to have of being present is not an intrinsic property, but a result of its location at the front end of the specious present. Similarly, the property *Do* has of being "just past" in the specious present [silence, *Do*, *Re*] is held not to be an intrinsic property of the experience of *Do*, but a result of its location in the middle of the specious present.

Even if this answer works, the temporal overlap model faces difficulties. In particular there is the difficulty of how long a specious present actually is. This is made particularly hard by the existence of conflicting experimental results. Which type of experiment gives the true value, if any? How do results about indifference points, or how many sounds can be grasped "as a whole", relate to the length of the specious present? The temporal overlap model is an improvement on Broad's account; but there are still enough

problems to prevent it being a clear favourite over Husserl. Both Husserl's account and the temporal overlap model have points in their favour; but equally both suffer from unresolved objections.

(x) Our Sense of Passage - Small-Scale Explanation

Since neither of the accounts I have looked at seem fully satisfactory, the problem is raised about how to explain our sense of passage on the small scale. We cannot even decide how we perceive a simple process like a short musical phrase! I have no answer to these problems of our temporal awareness. Instead what I will try to show is that on *both* accounts so far presented a reasonably plausible story can be told about how our sense of passage arises. Further I will try to generalize this to suggest that whatever account is suggested it is likely to be amenable to a tenseless explanation of passage.

Taking Husserl's account first, what the account explained (to whatever degree of success) is how we perceive (on the small scale) processes *as* processes, and how we perceive the continuity of our own acts of awareness and perception. What remains to be explained is the key puzzle: how does our sense of changing temporal perspective (i.e. our sense of passage) arise on the small-scale?

Recall first the account of our sense of passage that I suggested when talking about our large-scale temporal experience. Roughly, I argued that the source of our sense of passage was the feeling of *the very same self* progressing through a sequence of times and events. This feeling was rooted in two facts. Firstly, certain mental features and traits, an overall feeling of *what it is like to be a particular person*, remain constant throughout a diversity of experiences. Secondly, at any one time each person feels "complete" and wholly present.

It might be thought that since Husserl's small-scale account has a similar overall structure to my large-scale account, the idea of the very same self could be applied to the small-scale as well. But this approach is much less suitable here. Suppose that a person completely lacked a large-scale memory. As I mentioned above, this person would still have a sense of passage. But it is not clear that he or she would have any very developed sense of who they were, or of *what it is like to be the person they are*. This kind of sense is largely rooted in one's memory. Our sense of who we are is connected to *that part of ourselves which remains constant throughout a*

variety of experiences; and it is through memory - through remembering what we were like at other times - that we become aware of the more constant elements.

As I say, a person like this would still have a sense of passage while listening to a few notes of music or a few beats of their own heart. They would be aware of one note as fading away and another as approaching. What I think is needed is a *stand-in* for this notion of *the very same self*. This "stand-in" would apply when looking at small-scale temporal experience. My suggestion (derived from Horwich [1], Chapter 2) is that what is constant to all moments of a small-scale perception is, roughly, the same *experiential framework*. Horwich writes:

> ... we are aware of a succession of complex experiences. Each has the *same* structure consisting of a present sensation, anticipations with various degrees of projected futurity, and recollections of various types. And each has roughly the same content - a set of phenomena strung out in time. The difference between them is that the later that an experience is represented as occurring, the more pastness and less futurity it attributes to any given event. Thus we are conscious of the same experiential framework being filled with the same contents from different temporal perspectives. Therefore it seems to us as if a single entity - the structure of experience - is undergoing these changes. (Horwich [1], p.35-6)

Although Horwich himself applies this idea to the large-scale of recollections and anticipations, the idea is well-suited to present needs. The key is that *the general structure of perception and experience remains constant throughout a diversity of "contents"*.

On Husserl's account, consciousness during any perception of a single note or small group of notes divides into three main sections: a primal impression, a continuous manifold of retentions, and a continuous manifold of protentions. The actual content of the primal impression varies from moment to moment, as will the associated retentions and protentions, but the three-fold framework of primal impression, retentions and protentions is constant throughout this diversity of contents. See figure 7.7. Husserl's *double intentionality* means effectively that the whole content of a previous act of awareness is retended (protended) *including the framework in which this content exists*.

This means that at any one time there will be an awareness of the present contents of the experiential framework e.g. a particular primal

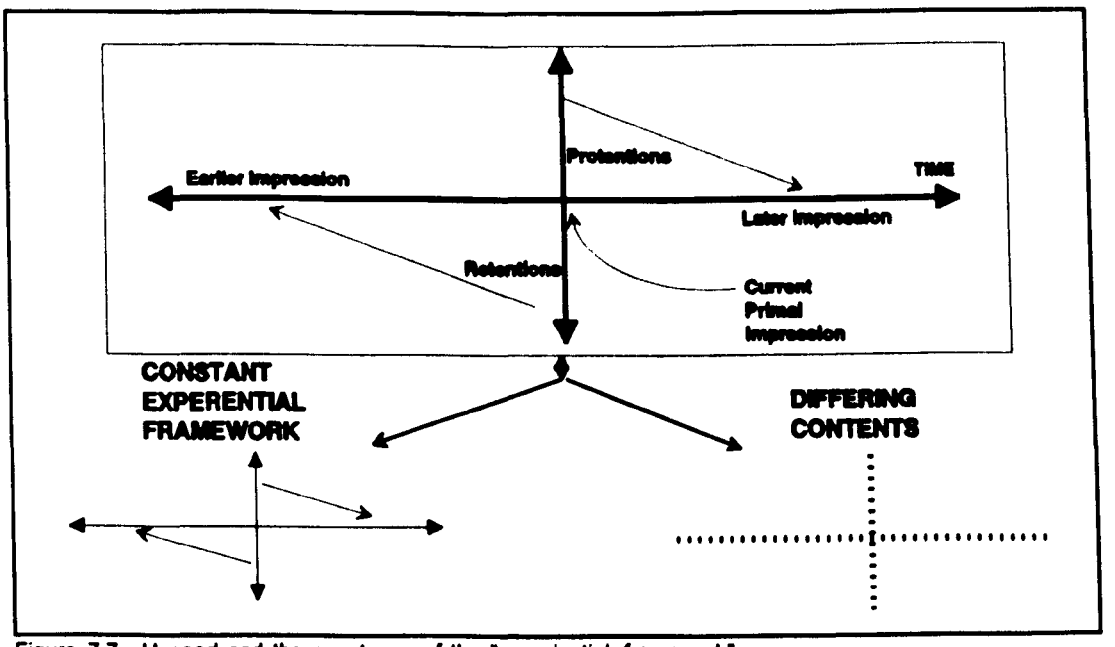

Figure 7.7. Husserl and the constancy of the "experiential framework"

impression, and particular sets of retentions and protentions. But there will also be a retention of the "same" framework filled with a different set of experiences (an earlier primal impression, and earlier set of retentions and protentions).

As well as this, each framework (or more precisely each slice of the tenselessly extended framework) appears as a complete framework in its own right. In other words it feels as if it is *wholly present* at each time.

Taken together, our experience is likely to appear to consist of the very same framework wholly occupying each time, and *progressing* through successive times and events. In other words, we will have a vivid sense of the same entity moving through time, and having different experiences at each time. In short, it will feel to us, even on this small-scale, that time is passing or that we are passing through time.

This approach can also be used when we come to the temporal overlap model. With this model, consciousness stretches across a short span of time. Once again the general structure of consciousness - *the experiential framework* - is the same at all times. It is as if a mirror were to be moved over a long line of objects. At any one time several objects are reflected in the mirror. See figure 7.8. The contents of awareness (the objects reflected in the mirror) vary; but the framework of awareness (the mirror itself) remains constant. Again, at any one time, this framework will appear to itself as complete and whole.

The constancy of this framework over time, together with its completeness at a time, leads to the feeling of a single entity moving through

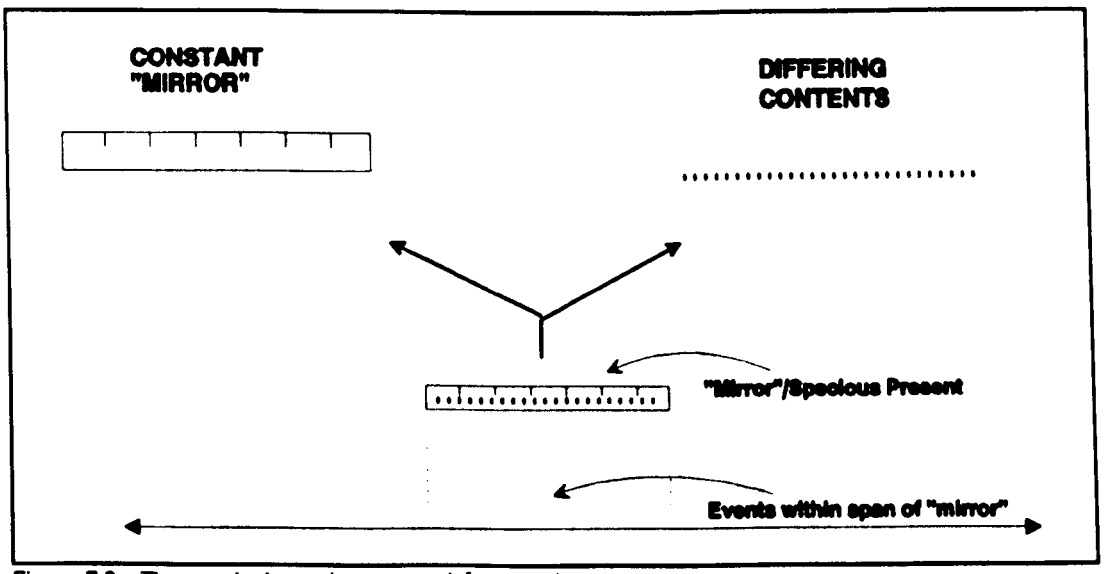

Figure 7.8. The constant specious present framework

a sequence of times and events. In other words, the contrast between this constant, complete framework, and the diversity of experiences successively filling the framework, will lead to a vivid, small-scale sense of passage.

This line of thought can be repeated at quite a general level. Experience of a process *as a process* must take place via a particular *experiential framework* E. The precise nature of E is to some extent irrelevant. We can say generally that E will be such that (i) earlier and later parts of a (small-scale) processes are in some sense "co-present" in consciousness, and (ii) earlier and later acts of consciousness are themselves "co-present" in consciousness. Whatever the precise nature of E, we will be aware of E as a constant complete framework ever being filled with a diversity of experiences. Consequently, our experience will seem to be of the same framework *progressing* through a sequence of times and events. The five elements of my large-scale explanation therefore repeat themselves on the small-scale:

(1) Our temporal experience takes place within an experiential framework E which makes possible our experience of processes *as processes*.

(2) Framework E also makes possible our experience of the continuous process of our own acts of awareness.

(3) Being aware of the continuous acts of our own awareness we are aware that E is a constant feature of each moment of consciousness, but filled with a diversity of contents at different times.

(4) The *completeness* associated with the experiential framework E at any instant, together with its constant structure, leads to the feeling *as of* an entity wholly existing at each time.

(5) Feeling that E wholly exists at each time, and being aware of a diversity of contents filling E from time to time, it feels to us as if E is progressing through a sequence of events, or as if these events are passing through E i.e. we have a sense of passage.

My suggestion is that these five elements combine to give rise to our small-scale sense of passage i.e. the sense of passage we have when we watch the second hand of a clock, or listen to the sound of our own heart beating.

This small-scale explanation probably plays the most important part in our overall sense of passage. But as I remarked when I began discussing our sense of passage, no single explanation of our overall sense of passage will be satisfactory. With this in mind I will now make a few suggestions about the three explanations so far offered (misuse of language, large-scale phenomenology and small-scale phenomenology) combine together and complement one another. After this I will then introduce a fourth element, linked to the experienced directionality of time.

(xi) Our Sense of Passage - A Combined Explanation

So far I have offered three main suggestions of how our sense of passage arises even given tenseless time. Firstly there is the mis(use) of language; then there is our large-scale phenomenology *as of* a self progressing or moving with respect to (large-scale) events; finally there is our small-scale phenomenology *as of* a single entity (an experiential framework) progressing or moving with respect to (small-scale) events such as a single note, or short musical phrase.

All these elements seem to have their part to play; and further there is a constant interplay between them, each reinforcing the "errors" of the others. Probably the root cause is our small-scale phenomenology. The phenomenological facts on the small-scale give us a strong inclination to feel as if we are progressing through time, that passage is taking place.

This feeling is naturally carried over to our large-scale experience, since large-scale experience is to some extent built out of many small-scale

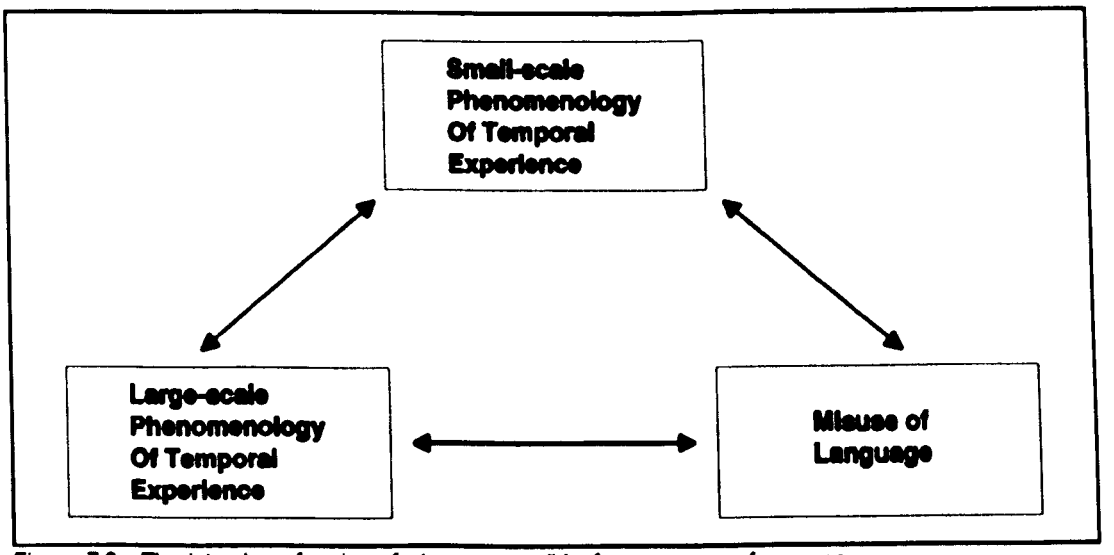

Figure 7.9. The interplay of various factors responsible for our sense of passage.

experiences joined together. But on the large-scale at least two additional factors arise.

Firstly, the idea of a constant self persisting through time becomes clearer. Rather than a constant experiential framework, on this level we have the idea of a person (complete with a name, characteristics, habits, etc).

Secondly, exploring the intricate facets of the large-scale category of "present experience" is a job for philosophers, psychologists and phenomenologists. When we ordinarily try to describe our temporal experience it is the large-scale of memory, present experience, and expectation that we talk about. It is on this level, then, that the mis(use) of language may have the most effect. I mentioned earlier a cluster of possible misuses of language. These misuses are probably inspired in part by the distinctive nature of our temporal experience; and helped along the way by the indexical character of words like "now" and "present".

Having once begun to misuse language in these ways, the idea of a constant self progressing through time becomes reinforced. The way we use language colours the way we think and even the way we experience. That is, *there is probably no such thing as a completely uninterpreted experience.* On the large-scale this way of understanding and talking about our experience becomes deeply entrenched, and will reinforce and develop my sense of a constant self progressing through time.

Having infected my large-scale experience, this (mis)use of language will also infect the small-scale. If I can describe my large-scale experience in this way, and if my large-scale experience is clearly related to my small-scale experience, why can I not carry over the same way of talking to the

small-scale? In this way we come full circle: our (mis)use of language and our (mis)understanding of our large-scale temporal experience infect the way we conceive (and even experience) what goes on on the small-scale. All three factors influence the others; and the net result is a structure in which each component strengthens and maintains every other. See figure 7.9.

(xii) The Direction of Our Sense of Passage

If the above discussion contains some truth, a rough explanation has been given of how our sense of passage arises. There still remains an important puzzle: why does the passage we experience flow *forwards* rather than backwards i.e. from earlier to later, rather than from later to earlier?

A full discussion of the direction of time will have to wait for the

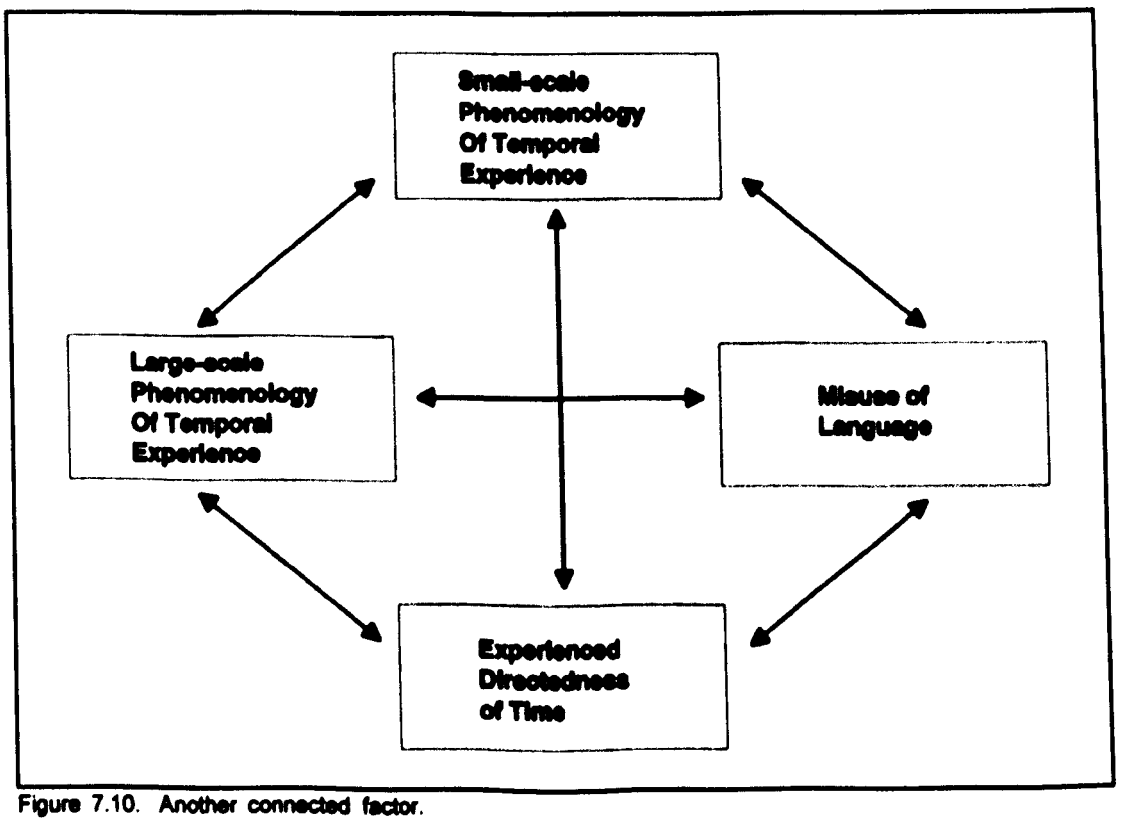

Figure 7.10. Another connected factor.

discussion of the following chapters. But it is worth noting that this direction is an important fourth element in our sense of passage. Most relevant here is the clear difference between memory and expectation, and the fact that both these phenomenon have *degrees*. This means that it is as if our experience has a direction running from distant memories through to near memories to near expectations and finally to distant expectations. Other

asymmetries in time will also be relevant. There are marked asymmetries in deliberation and action in our experience. We only deliberate on what we are going to do; what we have done is a matter of regret or pride, not something we can think about doing or not doing. Similarly, we only act in order to influence later events; about earlier events we say "it's no good crying over spilt milk".

The strong *directedness* in time of our experience is another important factor in our experienced sense of passage. Just as an electric current will not flow without a sufficient difference in potential (i.e. voltage) between two points, so the directedness of our experience (the difference in "potential" between the past and the future) can be seen as *inducing* flow and passage between the past and the future. This gives us an explanation of why our sense of passage *flows forwards rather than backwards*.

Again, this factor will interact with those already mentioned. The direction of time can seem to be closely linked with passage. Grünbaum points out that there is a tendency to confuse the two (see Grünbaum [1]). The question *is there a direction of time?* easily becomes *is there an arrow of time?* which is to say *is there a one-way forwards progression or flow of time*? See figure 7.10. I will leave further discussion of direction, however, until the following chapters.

(xiii) Is Our Sense of Passage an Illusion?

Hopefully the above account provides a plausible combined explanation of our sense of passage, compatible with the tenseless theory of time (i.e. invoking no ideas of metaphysical passage). I will conclude this chapter by asking briefly whether this account means that our sense of passage is essentially an illusion, misleading us into thinking that there is genuine passage.

In fact, the details of the account allow us to see which elements of our sense of passage are "illusory" and which have a firm basis in reality. See the table on the following page for a list. As can be seen from the table, our sense of passage splits into two parts, one part perfectly consistent with tenseless time; the other part incompatible. It is only this second part which must be regarded as in any sense illusory.

TENSELESS TRUTH BEHIND OUR SENSE OF PASSAGE	TENSED ILLUSIONS WITHIN OUR SENSE OF PASSAGE
The indexical nature of language (e.g. the way "now" can be used to denote different time; the varying truth-values of sentences like "the '45 rebellion is ten years ago"). The constant flux of our tensed beliefs, and the special nature of now-beliefs.	The misuse of indexical language (e.g. treating "now" like a concrete entity which roves across different times; or talking of events as if they genuinely recede into the past). Thinking that our changing tensed beliefs reflect a metaphysical change in reality; and that our now-beliefs reflect a metaphysical privilege belonging to the present moment.
Tenseless features of our large-scale temporal experience viz. the awareness of constant features of our mental life - *what it is like to be who we are* - coupled with the diversity of experiences at different times. Also the feeling of completeness we have at each moment of our existence.	The idea of the very same self *progressing* through sequences of experiences and events.
Tenseless features of our small-scale temporal experience viz. the awareness of a constant experiential framework coupled with a diversity of experiences filling that framework at different times. Also the feeling of completeness that characterises that framework at each time of its existence.	The idea of the very same experiential framework *progressing* through sequences of experiences and events.
The tenseless directedness of experience, in particular the clear difference between memory and expectation, but also connected to other asymmetries such as action.	The idea of a one-way forward flow or passage of time.

An interesting question to ask is whether we could ever be free of these "illusions" and put our temporal experience in complete accord with a tenseless reality. In terms of the table below it does not seem absurd that there should be some beings whose experience is characterisable in terms of the features in the left hand (tenseless) side of the table, but lacked all the "illusory" features of the right hand side. Such beings could clearly still use indexical language and have tensed beliefs (but without getting in a mix-up). These beings would be able to perceive processes, they would be aware of the continuous process of their own acts of perceptions (without "polluting" this experience by adding the idea of the very same entity progressing or moving through time). Finally they could be aware of the marked directedness of experience, the difference between memory and expectation, the difference between trying to alter later events and earlier events (without regarding this directedness as being based in a one-way forward flow or passage of time).

The existence of such beings seems to me by no means absurd or inconceivable. They would be able to live in time, to perceive things from a temporal perspective, to act properly and at the right time[38]. But it is fairly clear that their experience would nevertheless be a great deal different from our passage-ridden way of looking at the world. It seems likely that for us passage is so deeply ingrained in our experience that we could never become like these beings.

However this is pure speculation. It is hopefully enough to have shown that a large proportion of our sense of passage can be accommodated by tenseless time; and that it can be understood how the illusory aspects that are left - whether eliminable or not - can arise from tenseless sources. Granted that this has been shown, our sense of passage can be accommodated and adequately explained by the tenseless theory of time.

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[38] That is, they would still perceive the world from the standpoint of a temporal being: they would not view things atemporally in the way an eternal timeless God might.

Chapter Eight

The Direction of Time

(i) Introduction

One of the most striking features of time is that it has a *direction*. Past and future, earlier and later, are intuitively very different. The direction of time manifests itself in many of our most familiar concepts. We *act* to affect the future, not the past. We tend to *know* more about the past, but can only guess about the future. In the world around us, too, many everyday occurrences reveal a direction. When cold water is added to a hot bath, the waters mix and the temperature levels out; it never happens that an ordinary bath begins to boil at one end and freeze at the other!

Over the next two chapters I will be exploring issues connected with the direction of time. The point of these chapters in terms of the overall thesis is that passage and direction seem closely connected. The question is: *does "direction" require a passage model of time?* As I will discuss later, passage from the past to the future initially appears ideal for giving time a clear direction. Passage also initially appears to explain the directedness or time-bias we find causation, knowledge etc. However, the direction of time is also an interesting topic in its own right and I will occasionally wander further afield than is strictly necessary for the purposes of the thesis.

The very first problem is to understand in what sense time has a direction. Otherwise, it is not likely that any discussion will shed much light. As John Earman says in his paper "An attempt to add a little direction to 'the problem of the direction of time'":

> Of all the problems which lie on the borderline of philosophy and science, perhaps none has caused more spilled ink, more controversy, and more emotion than "the problem of the direction of time" ... What is curious, however, is that despite all the spilled ink, the controversy and the emotion, little progress has been made towards clarifying the issues. Indeed, it seems not a very great exaggeration to say that the main problem with "the problem of the direction of time" is to figure out exactly what the problem is or is supposed to be" (see Earman [1], p.15)

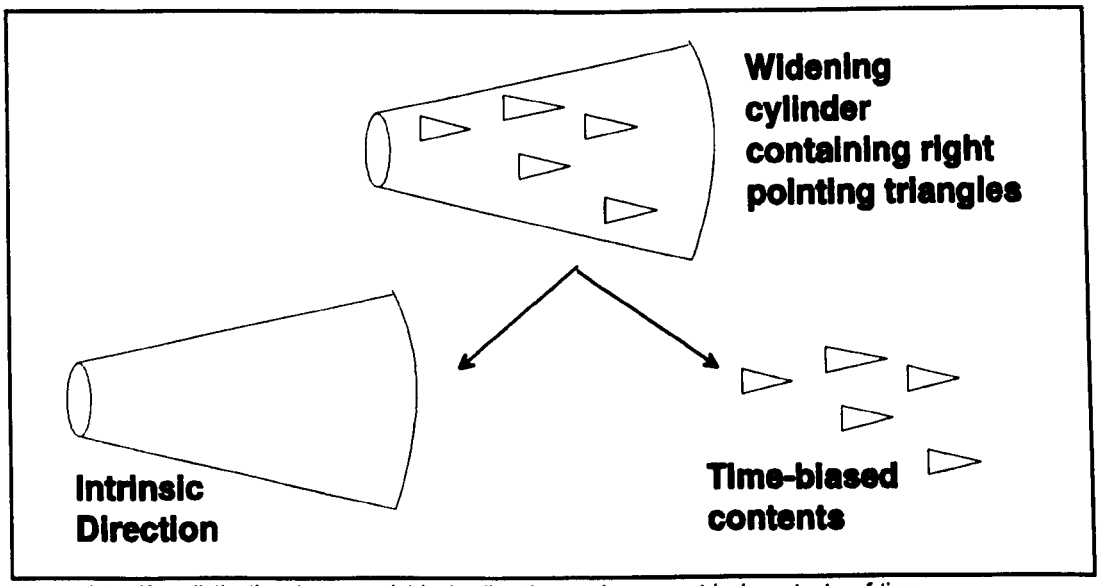

Figure 8.1. The distinction between intrinsic direction and asymmetrical contents of time

As a first step towards getting a grasp of the issues it is useful to distinguish between, on one hand, the direction of time itself and, on the other hand, the directedness of various concepts and processes *within* time - knowledge, causation, action, etc.

For a rough analogy of what this distinction amounts to, consider a long cylinder that is thin at one end and widens steadily towards the other end. See figure 8.1. Now imagine that this cylinder is filled with isosceles triangle shapes which are oriented so that the vertex joining the two equal sides of each triangle points towards the thick end of the cylinder.

The widening of the cylinder represents the intrinsic asymmetry of time. Regardless of what is put into the cylinder and how it is arranged the cylinder still has direction from the thin end to the thick end (or from the thick end to the thin end). The triangles represent the direction or asymmetry found in the *contents* of time i.e. in various events and processes that occur in time.

The cylinder example suggests the possibility that the direction of time itself (the *intrinsic direction* of time) and the directedness of processes within time (the *asymmetrical contents* of time) need not always go together. If the cylinder did not widen but stayed the same width along its length then there would be no particular direction associated with the cylinder in itself. But the triangles may be arranged in a directed manner. This possibility would represent a universe in which time itself had no intrinsic direction, but there was still a directedness of the contents within time. Figure 8.2 shows different possibilities of this sort.

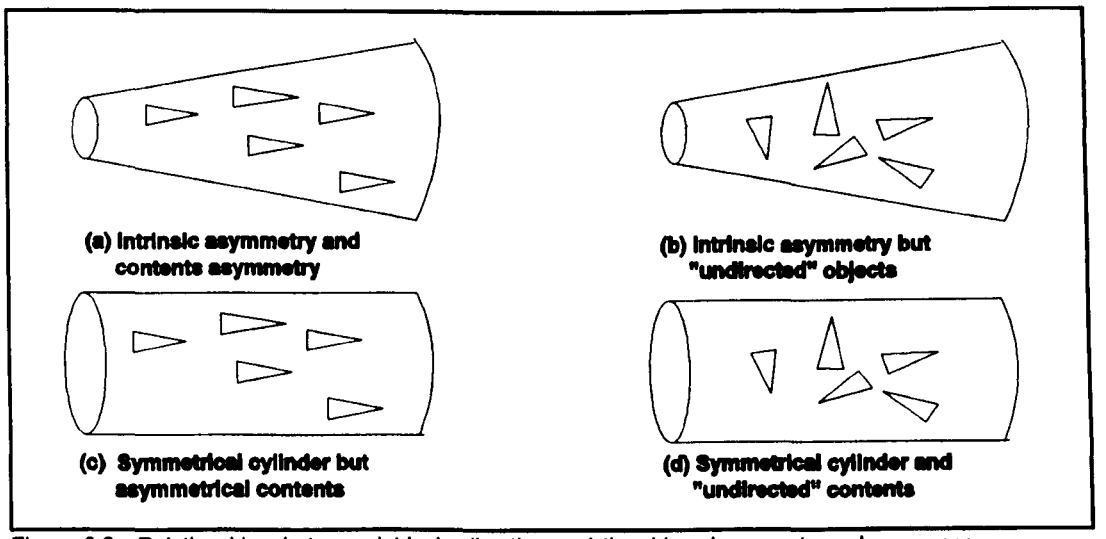

Figure 8.2. Relationships between intrinsic direction and time-biased concepts and processes

(ii) Asymmetries in Time

The above distinction is still fairly crude, especially since the idea of the intrinsic direction of time itself is unclear. The main theme of this chapter will be to clarify this notion, explore its connection with passage, and to ask whether time really has an intrinsic direction at all. First, though, I want to introduce some of the *contents* of time which show a significant bias between past and future. I will refer to these variously as *time-biased* contents, or *asymmetries* in time. Consider the following list:

(a) Causation. Causes almost always precede their effects. If there is a thunderstorm during the night and a bolt of lightning hits a tree, then the following morning we might find that the tree was burnt or fallen. The bolt of lightning is the cause and the tree falling is the effect. It would seem very odd to us if the bolt of lightning somehow caused the tree to be burnt or fallen *on the evening before the thunderstorm took place*, or to say that the falling of the tree caused the *earlier* flash of lightning.

(b) Explanation. The way we explain things can also follow an asymmetrical pattern, since our explanations are often causal (i.e. explaining why some event has happened in terms of what caused or brought it about). We explain that the tree fell because it was struck by a lightning bolt, rather than that there was a lightning bolt because the tree fell.

(c) Knowledge. There is a bias with respect to our knowledge of the past and the future. In general we know more about the past than the future, or it is *easier* to know the past than the future. We remember what we did yesterday, we know facts about who was King of England five hundred years ago, we have evidence about what sort of creatures lived at the time of the dinosaurs. But our future knowledge is far more sketchy: we can guess, predict, hope that things will turn out in a certain way, but can rarely be sure that they will.

(d) Value/Concern. People worry about going to the dentist when the visit is in the future, and feel a sense of relief when they finally get it all over and done with. This shows a difference in the concern we feel about past and future events. Given a choice between being at time t(1) which is shortly before being given a very painful electric shock, and time t(2) which is a few minutes after the shock, most of us would prefer to be at t(2), perhaps still in pain but knowing at least that the worst pain is over with.

(e) Action and Decision. We act to affect the future, to bring about certain results. But we think that it is misguided to try to change the past ("there's no point crying over spilt milk"). In a similar way we make choices about what to do at future times, but not at past times. I can decide whether to go out for a walk this evening for some fresh air, but not about whether to go out for a walk yesterday evening. If I did go out for a walk, then I did: nothing I can do can change that fact so it seems absurd to decide whether to do it or not.

(g) Entropy. Another asymmetry is to do with entropy. Entropy is (roughly) a measure of how ordered a particular physical system is. Highly ordered systems have a low entropy, disordered systems have a high entropy. This asymmetry covers a vast range of apparently irreversible processes. When cold water is added to a hot bath, the waters mix and the temperature of the bath drops slightly and "levels out", so that given enough time the temperature will be the same all the way through. The reverse case never happens - we never find ourselves sitting in the bath with one end becoming boiling hot and the other end freezing! The irreversibility of this process (and many others) can be partly explained by the Second Law of Thermodynamics which states that entropy/disorder (almost) always increases.

(h) The "Fork Cluster" of Asymmetries. The following asymmetries all appear to be closely related. For convenience I will refer to them collectively as the "fork cluster" of asymmetries, so-named because of one of the asymmetries in this group: the *fork asymmetry.* The fork asymmetry states roughly that correlated events usually have a common cause but not a common effect. When someone lights a match, the match flame gives off heat and light. The heat and light are correlated (i.e. consistently occur

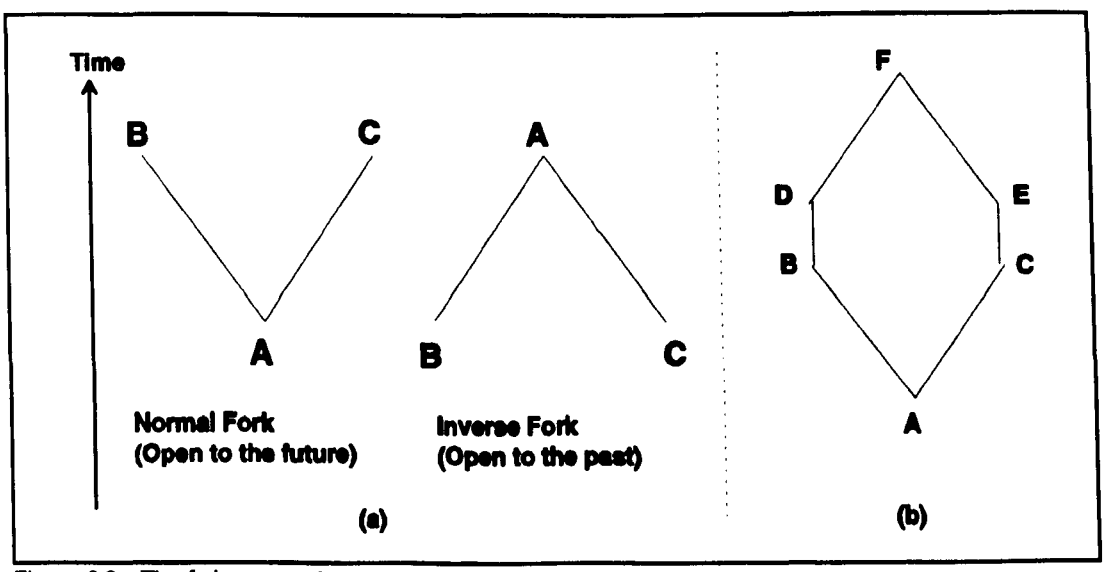

Figure 8.3. The fork asymmetry

together) and this can be explained in terms of a joint cause (the lighting of the match). This pattern of events lies in what is called a *normal fork.*

The opposite case (an *inverse fork*) seems to be rare. There are some cases of overdetermination - for example when someone gets run over by a bus at the same time as they are shot. In this case there are two events which have a common effect, but they are not correlated. It is just a coincidence that the bus should knock the person down at the very same time at which they are shot. The fork asymmetry is shown in figure 8.3 (a).

Note that although I have presented the asymmetry in terms of common causes/effects, the asymmetry is more correctly presented in terms of the patterns of correlations found in the world. Events are often found to be correlated in such a way as to form a v-shaped fork open towards the future (a normal fork) but v-shaped forks open towards the past (inverse forks) are very rare. I will expand on this near the end of Chapter Nine.

Finally, the fork asymmetry as presented needs to be qualified. There is in fact one area where inverse forks appear to be more common. This is where animals or people are involved. For a simple example, when lifting a

heavy object two or more people coordinate their efforts to produce a single effect (the lifting of the sofa). This falls into an inverse fork pattern: the "prongs" of the fork are respectively "person A straining their muscles" and "person B straining their muscles"; the "tip" is "the lifting of the sofa".

The important thing to note about this sort of example is that the inverse fork will always "follow on" from an earlier normal fork pattern. For example, before the two people lift the sofa, a coordinating onlooker might have counted "one ... two ... three ... lift!". Both people will react to this count and then lift. So we have a normal fork with the two "prongs" being "person A hearing the count" and "person B hearing the count", and the "tip" being the onlooker's word "lift!". So the whole situation will have a structure as shown in figure 8.3 (b).

Although any statement of the fork asymmetry has to allow for this sort of thing, the basic asymmetry still holds. The majority of normal forks will not be followed on by an inverse fork. And *without the earlier normal fork* the inverse fork structure would be highly unlikely. Two people are unlikely to decide to lift the sofa at exactly the same time for *completely independent* reasons. Therefore normal forks will heavily outweigh inverse forks.

Connected with the fork asymmetry is the idea of *innocence*. Imagine two particles heading for a collision with each other. The particles have never collided before, and belong to systems which have never interacted before. Then the particles collide and head off in new directions. The intuition is that before the collision there is no correlation between the velocities or momentums of the two particles - they are *innocent* of each other. Afterwards there may well be some correlation between their velocities. For example, one particle may have suffered a sudden increase in velocity, which is correlated with the other slowing down slightly. This correlation is due to the fact they have now interacted and affected one another: *they are no longer innocent*.

Another asymmetry in this group is to do with waves. When a pebble is dropped into a still pond, a series of waves ripple outwards from the place where the pebble was dropped. See figure 8.4 (a). This is common, but the reverse case in which a series of waves start from the edge of the pond and move towards a common centre is almost unheard of. It might be possible to bring this about by placing small wave generators all around the edge of the pond and starting them in harmony, but it would never happen spontaneously and naturally.

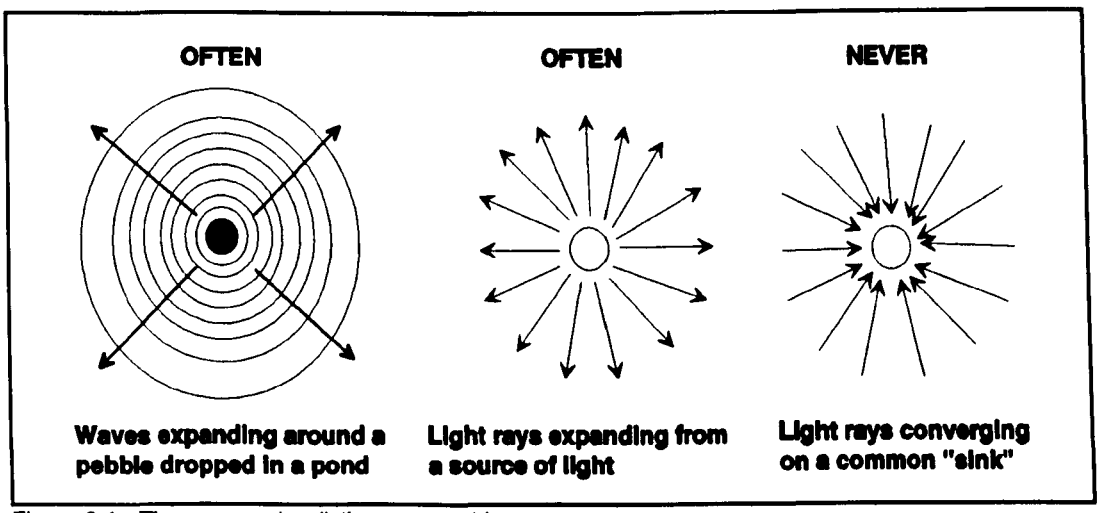

Figure 8.4. The wave and radiation asymmetries.

The same asymmetry applies to light (or, more generally, radiation). Light waves are often found to move outwards from a common source (e.g. a light bulb, or the Sun) but almost never to converge inwards upon a common "sink". See figure 8.4 (b) and (c).

(iii) Explanatory Maps

Over the last few pages I have introduced quite a number of time-biased concepts and processes. A difficult problem with these asymmetries might be called the *taxonomy problem* (see Price [1], p.17). There are clearly some significant connections between the asymmetries. Sometimes this is obvious: the time-biases in explanation and in causation are connected, since causes *explain* their effects but not vice-versa. There are other less obvious connections. It has been argued by some that the knowledge asymmetry can be explained by entropy, or that the causal asymmetry can be explained in terms of forks.

The *taxonomy problem* is very complex. A useful device for charting the complex relationships between the asymmetries is used by Paul Horwich in his book "Asymmetries in Time". Horwich arranges the asymmetries into an *explanatory map*. The lowest level asymmetries appear on the left. The arrows between asymmetries indicate that the lower level asymmetry underlies or explains the higher level asymmetry. For an example of an explanatory map (and also for an indication of the complexity of a complete solution to the taxonomy problem) see figure 8.5 showing Horwich's map. The lowest level asymmetry is the "initial conditions" box (this means the initial conditions which obtained in the early stages of the universe). This

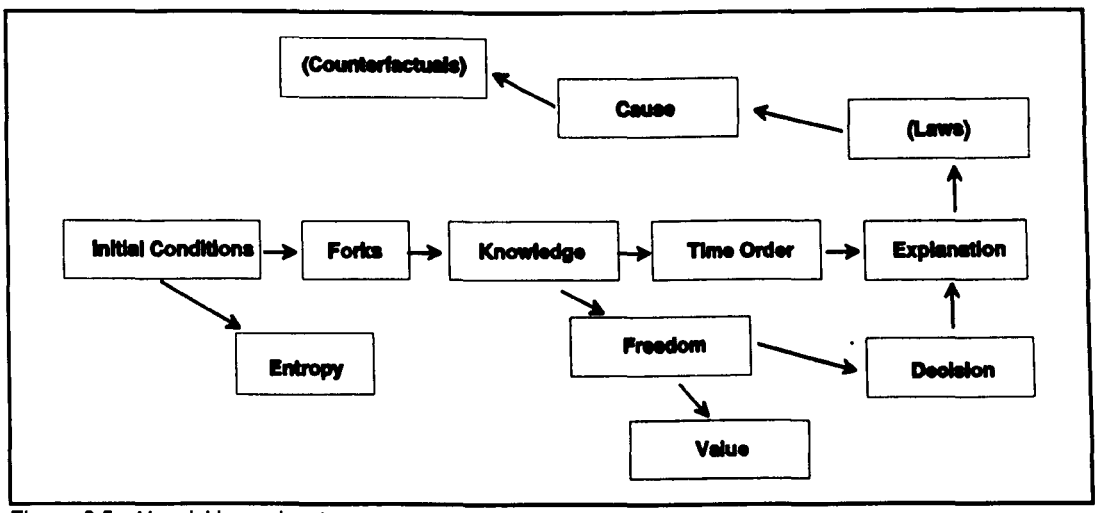

Figure 8.5. Horwich's explanatory map

asymmetry explains entropy and the fork asymmetry. Initial conditions together with forks explain the knowledge asymmetry; these three asymmetries together explain our concept of time order and our sense of freedom to act and influence the future. And so on.

(iv) Intrinsic Direction

The idea of explanatory maps brings the discussion back to intrinsic direction. Why believe that time has an intrinsic direction, whatever this may actually amount to? The main reason seems to me to be the large number

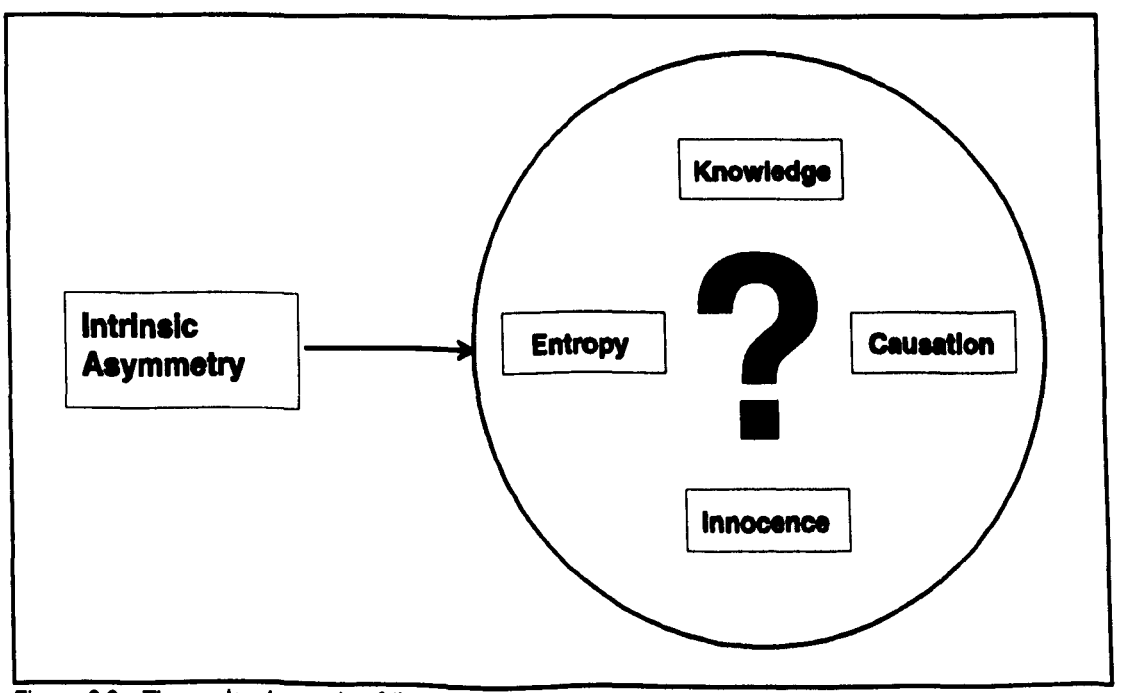

Figure 8.6. The explanatory role of the intrinsic asymmetry of time

of asymmetrical or time-biased contents within time. If time had no intrinsic direction (if there is no essential difference between earlier and later, past and future) then the existence of so many asymmetries would be surprising.

In terms of an explanatory map, intrinsic direction could provide the essential first starting point. Whatever other interrelations there are between various asymmetries, the general form of the map would be as shown in figure 8.6. Here the intrinsic direction of time acts as a *unifying explanation* of the multitude of content asymmetries we see about us every day.

If time is intrinsically directed, what does this mean? Whatever the details, I think any account of intrinsic direction must satisfy three main criteria.

The first criteria was mentioned in section (i). Using the cylinder analogy, there is a significant difference between a cylinder which widens steadily towards one end, and a cylinder staying the same width all the way along. Only the widening cylinder is a candidate for having intrinsic direction. This is because there is non-arbitrary difference between the two ends of the cylinder. Going towards one end the cylinder widens; going towards the other it narrows. If the cylinder's width were the same in both directions, then there is only an arbitrary difference. We can label the ends "X" and "Y" and talk of the direction towards end X and the direction towards end Y. But this doesn't give the cylinder intrinsic direction. What is needed is some more genuine difference between the two directions e.g. the widening/narrowing of the cylinder in one direction.

Secondly, when time is drawn as a line, we usually add an arrow to indicate that time "goes" in a particular way. In other words, time has a *preferred* direction. This is different to the first criteria. Although there was a non-arbitrary difference between heading up or down the widening cylinder, neither of these directions is preferred. The cylinder runs just as much from wide to narrow as it runs from narrow to wide. Time on the other hand does *not* run from later to earlier: its preferred direction runs exclusively from earlier to later.

Thirdly, since the main reason for believing that there is an intrinsic direction of time is the existence of so many asymmetries, an account of intrinsic direction should offer some explanation of why these asymmetries arise.

To sum up, three criteria for intrinsic direction are:

(i) There should be a non-arbitrary difference between the two directions earlier-to-later and later-to-earlier.

(ii) One of these directions should be preferred.

(iii) Intrinsic direction should explain the many asymmetrical contents of time we find around us.

(v) Passage and Intrinsic Direction

At first sight passage seems to be an ideal candidate for providing time with an intrinsic direction. It appears to fulfil all three criteria. There is clearly a non-arbitrary difference between earlier and later: the moving-now for example moves *away* from earlier times but *towards* later times. The moving-now would also make the earlier-to-later direction preferred, since this is the direction in which the "now" heads. Finally, as I will outline later, a combination of the movement of the "now" and the ontological distinctions between past and future can be used to give some account of many asymmetries.

To expand on the way passage meets the first two criteria, reflect that one clear sense in which the word "direction" is used is when talking about moving objects (a car travelling *northwards*, a bus moving *towards* the city centre). The connection between the passage of time and ordinary motion suggests an account of the direction of time. This is clearest with the moving-now conception of passage (the privileged moment "now" moves *from* the past *towards* the future); but the same directedness appears in McTaggart-type passage (events change *from* being future *to* being past).

A problem with linking passage or flow with intrinsic direction is simply the serious problems there are with making sense of passage. In a way, the arguments of the first four chapters of this thesis are also an argument against linking passage with intrinsic direction. But there are some additional problems specifically to do with the suggestion that passage accounts for the direction of time.

Recall the *rate of flow* argument. I argued that the dilemma for a passage-theorist was three-fold. Taken over-literally passage is absurd. Time does not literally pass, the now does not literally move into the future, events do not literally change from being future to being past. So "passage" has to be understood as a metaphor. But then the problem is either that

"passage" is just completely obscure and we don't really know what it means; or an account is given of what lies behind the metaphor. If an account is given, the problem is that the accounts collapse into unusual but nevertheless tenseless models of time.

So tensed models which retain some genuine passage but avoid absurdity tend to take the second horn of this dilemma: it is admitted that passage is a metaphor but no truly adequate explanation is given of the reality that lies behind the metaphor. In this case we know that whatever the reality underlying the moving-now metaphor, *nothing like motion can be involved.*

Passage seems useful for explaining intrinsic direction precisely because ordinary flow and motion can be assigned a clear direction. But whatever is really meant by saying that the "now" moves is as radically different to motion as it could be. This means that there is no justification for thinking that the clear sense of direction that we can apply to a car travelling northwards can be applied to the moving "now". And even if some concept of "direction" can be applied, the concept of direction used must be radically different to the ordinary sense in which a car travels north. The difference will be so great that there is little guarantee that the sense in which the "now" moves in a particular "direction" would help explain time's intrinsic direction. Rather than explaining intrinsic direction, the passage-account seems to me more likely to make things obscure[39].

(vi) Passage and Asymmetries Within Time

What about the third criteria - that intrinsic direction should provide a unifying explanation for the many asymmetries we find? Again passage initially seems ideal. Using the direction of the moving "now" together with the ontological asymmetry between past and future some explanation can be given of asymmetries like causation and knowledge.

Why do causes precede their effects? A cause is (roughly) an event which brings it about that some other event occurs. Because the past is

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[39] McCall's branching universe-tree model of time might be thought to be an exception. McCall thinks that a great advantage of his model is that it gives a clear sense in which time is directed. The universe-tree has a *topological* difference between the past and the future - the future has many "branches", the past has only a single "trunk". But although the topological asymmetry of the universe-tree does provide a way of distinguishing between past and future, it doesn't by itself make one direction preferred. Why should we think of the universe-tree as spreading from the single trunk to the many branches, rather than converging from the many branches to the single trunk? The answer is that there is passage - branches are lopped off as the "now" moves up the structure of the tree. But as I pointed out in my discussion of McCall's model in Chapter Four this passage is unexplained and obscure: it is therefore unlikely to be of help here.

fixed, no present cause can affect the past. But the future is still open to influence. Present causes can ensure that certain future possibilities will eventually become realized precisely because the future is still only a realm of *malleable possibility*.

To come to knowledge, whatever else might be said it is at least true that we cannot know that some proposition p is true if there is not as yet any fact of the matter about whether p is true or not. If the future is a realm of undecided possibilities then how is it possible to know the future?

The bias in value/concern can also be given a plausible explanation. I fear future visits to the dentist more than past ones because the future ones *are going to become real*. The passage of time inexorably rushes me towards the dentist's chair. But once the visit is over any pain is now only part of the fixed but lifeless past. Every moment takes the pain further away, and nothing can possibly bring the same visit back again.

To a certain extent these explanations are plausible, although much more would need to be said. Obvious problems only appear when the more physical asymmetries are considered. Take entropy: when I mix cold water into my hot bath, why does the water mix and the temperature "level out"? And why does the reverse (water separating into hot and cold ends) never occur? The answers to these questions are a difficult matter of physics. Saying that time passes, or that the past is more real than the future, sheds no light on the matter at all. Similarly with the fork asymmetry. What has it to do with the passage of time that events tend to cluster in normal forks (open to the future) but not inverse forks (open to the past)?

In fact the asymmetries of the contents within time can be seen as dividing into two main groups. In one group is causation, explanation, knowledge, concern, action, and decision. In the other group are the fork asymmetry, innocence, the wave asymmetry and entropy. The passage-model can offer some explanation of the first group of asymmetries, but apparently none at all for the second group. For the moment I will refer to these two groups respectively as the *human* group of asymmetries and the *physical* group of asymmetries. An explanatory map showing this would be something like figure 8.7 (a). In this diagram, passage is shown as explaining the human group of asymmetries; but the physical is left wholly unexplained.

How are the asymmetries in the physical group to be explained? There seem to be two main alternatives, both of which undermine the idea that passage accounts for the intrinsic direction of time.

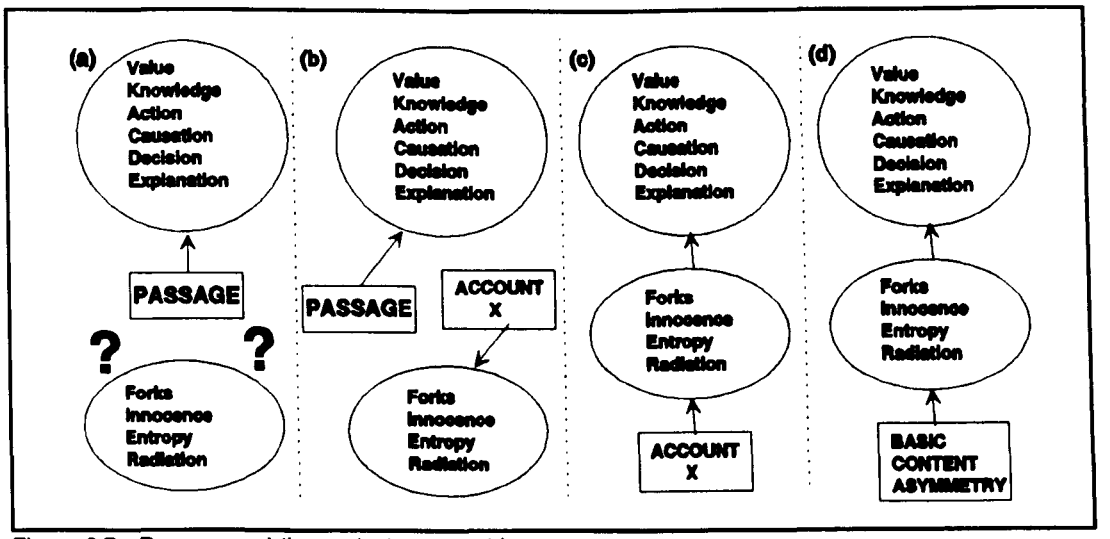

Figure 8.7. Passage and the content asymmetries

Firstly, the main reason for supposing that time has an intrinsic direction is the existence of a number of content asymmetries. Repeating this argument for the physical group of asymmetries implies that the unifying explanation for these asymmetries must be the intrinsic direction of time. But passage cannot fill this role, *therefore we must find some other account of intrinsic direction to explain forks, entropy, etc.*

This leads to an odd situation. There are a large number of content asymmetries, which lead us to suppose that time has an intrinsic direction. One group of these can apparently be explained in terms of passage. Another group of these cannot be explained by passage, but only by some other account of intrinsic direction: call this account X. This is shown in figure 8.7 (b).

But surely time cannot have *two* intrinsic directions. And if not, which is the correct account, if either? If some content can be given to account X, it is likely that this will be the best account. The reason for this is that the two groups of asymmetries are not separate. There are explanatory links between members of separate groups. The important point is that it is *always asymmetries in the second group (forks, etc) that are held to be more explanatory basic.* For example, some philosophers have argued that entropy provides an explanation for the knowledge asymmetry; others have made use of the fork asymmetry to explain causation or explanation. Since entropy and forks are being supposed to be explained by account X, the direction of explanation runs from account X to the human group of asymmetries *via the physical group.* This is shown in figure 8.7 (c).

Where is the place for passage in this explanatory map? The asymmetries that passage appeared to explain (knowledge, causation, value,

etc) are already explained in terms of account X via the physical group of asymmetries. Using passage would lead to these asymmetries being *overexplained*. In other words passage is *redundant*: there is no need for it in this context.

The second approach avoids introducing any mystery account X. We might suppose that the physical group of asymmetries can be explained in terms of a very basic content asymmetry, rather than by intrinsic direction. For example, the set of initial cosmological conditions which obtained at the time of the Big Bang, contrasted with the conditions towards the end of the universe, form a very fundamental asymmetry in the contents of time. In this case the situation would be as shown in figure 8.7 (d). A basic content asymmetry would underlie the physical group of asymmetries and these in turn would underlie the human group of asymmetries.

One problem with this is that we would have to simply accept a brute content asymmetry. We would have to accept that some asymmetries can be given no further explanation (e.g. in terms of some underlying intrinsic direction). Someone might object that if we accept this, then there is no reason why we shouldn't just accept all the asymmetries we see around us as being unexplainable matters of fact, which is clearly wrong.

But there are some important differences between accepting one (or a few) very basic content asymmetries as brute matters of fact, and accepting *all* asymmetries as brute matters of fact. Firstly, clearly not all content asymmetries are unexplainable. Whatever the precise details, asymmetries like knowledge, action and value, derive from more fundamental asymmetries. Secondly it is the sheer number and obvious connectedness of the content asymmetries that make the idea of an underlying intrinsic direction compelling. But neither of these considerations apply when only one or two brute asymmetries of a very fundamental sort are involved.

I will discuss this more at the end of the chapter, but for now note that the consequences for passage are the same as when account X was introduced. There will be a perfectly sufficient chain of explanations running from one or two basic asymmetries, through the physical group, and finally reaching the human group. Passage-type explanations are again redundant.

So despite the initial plausibility of passage-explanations of some of the content asymmetries, the usefulness of passage here is doubtful. It was found in the last section that passage does not meet the first two criteria of an account of intrinsic direction; it can now be seen that it is doubtful that passage meets the third. Overall, although at first sight passage seemed an

ideal candidate to account for intrinsic direction, it turns out that this account is full of problems.

(vii) Entropy and the Second Law

Given the difficulties with the passage account of intrinsic direction, what alternatives are there? What candidates are there for the mysterious account X? Over the last half of the chapter I will be exploring whether the notion of entropy can help. There are also two other suggestions worth exploring - one appealing to the laws of nature, and one to the causal theory of time- but for reasons of space I will not discuss them here.

Entropy is one of the most frequent notions to appear in discussions about the direction of time. Entropy is often held to be the one aspect of physics that gives time its "arrow". Entropy-based explanations have also been offered to explain why we know more about the past, and why our experience of time is future-directed. Because of the strong claims made about entropy I will explore in some length whether entropy can ground time's intrinsic direction. A clear account of entropy will also be useful for the discussion of the content asymmetries in the next chapter.

The notion of entropy originally arose in connection with the *Second Law of Thermodynamics*. Thermodynamics is the study of energy transformations. For example, when a hot object and a cold object are brought into contact energy is transferred from the hot object to the cold one. Another example is a gas in a tube. If the gas is suddenly compressed by a piston then its internal energy (i.e. the kinetic energy of the gas's molecules) will increase, making the temperature rise. These are the sort of situations that thermodynamics studies.

The Second Law of Thermodynamics is broadly to do with the spreading out or dissipation of energy. If hot water and cold water are mixed in a bath they will merge and the temperature throughout the bath will level out. The "high energy" of the hot water spreads out into the "lower energy" cold water. Finally the situation reaches a state of *equilibrium*, in which the energy is completely spread out i.e. evenly distributed throughout the bath. At this stage every point of the bath has more or less the same temperature. We would expect the bath to then remain in this state of equilibrium. It would be bizarre if one end of the bath suddenly began to grow hot again, and the other end cold.

The notion of *entropy* has its origins in this kind of situation. Roughly entropy is a measure of how much the energy of a given system has spread out. When the hot and cold water are first added but not yet mixed, the bath is in a state of low entropy. When the bath reaches equilibrium (an even temperature throughout) the bath is in a state of maximum entropy.

The Second Law of Thermodynamics can be roughly expressed by saying that entropy will always increase over time. Formulated in this way the law is clearly asymmetrical: entropy increases over time but never decreases. This asymmetry, together with the fact that almost every other physical law is symmetric with respect to time direction, explains why entropy has been held to be so closely linked with direction.

The claim that entropy always increases needs to be qualified however. The Second Law strictly speaking only applies to isolated systems. These are systems that neither give out or receive energy or matter from the outside environment. A gas sealed off inside a heat proof container is a simple example. When dealing with non-isolated systems we often see things apparently *decreasing* in entropy. A simple example is the hot water initially put in the bath. At some earlier point this hot water would have been cold. Prior to being put in the bath it would have been made hot (e.g. by the boiler), which means that the entropy level of the water *decreased.*

How does this square with the Second Law? The answer is that entropy can decrease in one particular place by drawing energy from the surroundings. To get hot water, "outside" energy obtained by burning fuel or using electricity must be used. The water decreases its entropy, *but this is at a cost of an overall decrease when the surroundings (the burnt fuel etc) are taken into account.*

(viii) Boltzmann's Statistical Mechanics

The notion of entropy was refined greatly by Boltzmann. Boltzmann explained thermodynamic laws and properties in terms of statistical mechanics (i.e. in terms of velocities and momentums of the molecules of the gases, liquids or solids involved). This statistical treatment opened up a new way of understanding entropy.

Imagine a box containing a gas. The box can be partitioned in the middle. See figure 8.8. Suppose that initially the partition is in place and all the gas molecules are in the left hand half. When the partition is removed we would expect the gas to spread out to fill the rest of the container. We can

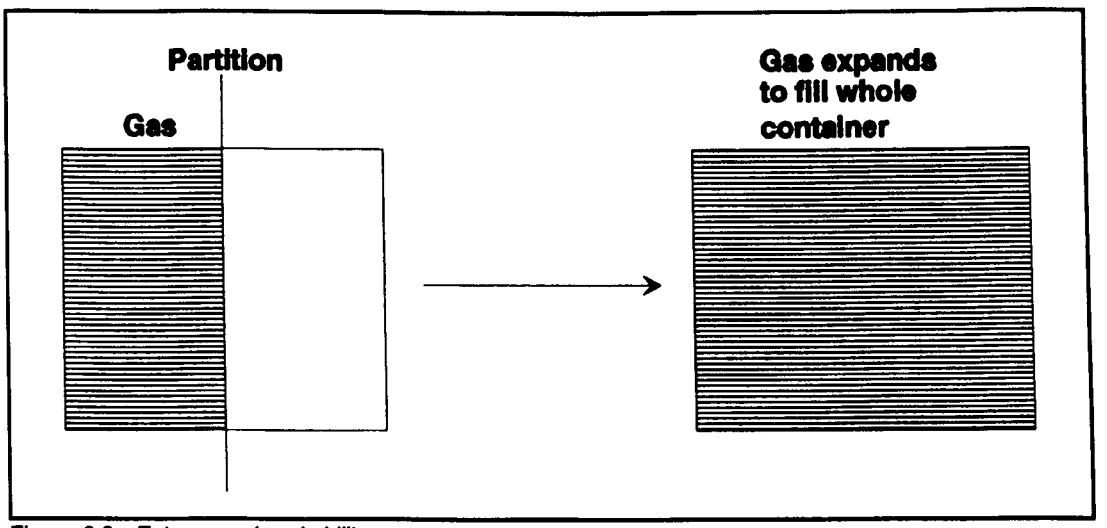

Figure 8.8. Entropy and probability

understand why this happens by focusing on the probabilities of different arrangements of the gas molecules.

What is the most likely way the molecules will be arranged after the gas has been left to evolve on its own for a time? Once the partition is removed many more possibilities become open. If one worked out the number of possibilities in which the gas spreads out more and compared this figure to the number of possibilities in which the gas contracts and huddles into one small corner, one would find that there are many more scenarios in which the gas spreads out. So left to evolve at random, it is highly probable that the gas will enter into a more dispersed state.

In other words, it is as if someone were told to choose at random from a bag containing 1000 cards. 999 of these cards have "more dispersed" written on them, and only 1 has "less dispersed". The overwhelming probability is that they will get a "more dispersed" card.

In more dispersed states the entropy is higher. Thus the increase of entropy is due simply to the gas evolving in the most probable way. Boltzmann showed conclusively that the arrangement realizable by the most number of ways of distributing the molecules corresponded to a state of equilibrium and maximum entropy. Simple rules of probability ensure that a randomly evolving gas will gradually make its way towards equilibrium.

This deeper understanding of entropy allows a link to be made between entropy and order. It can be seen that highly ordered states (e.g. a gas distributed in just one corner of a container, or one hot object surrounded by cold ones) are relatively improbable. Conversely, homogeneous states (when a gas is evenly distributed etc) are much more probable. Because of this entropy can be seen as a measure of how *disordered* a system is.

This advance in understanding, however, undermines the asymmetry of the Second Law in several ways. Firstly, the law is now only statistical. Very probably the entropy of an isolated system will increase, but not definitely. It is unlikely that a bath will separate into hot and cold end; but it is not physically impossible.

Secondly, in the long term, the evolution of an isolated system *should not show any asymmetry at all.* If we had to place bets on what state a given gas G is currently in, then Boltzmann's analysis implies that states near to equilibrium would have short odds, and states far from equilibrium would have long odds. So we should expect to find most gases in a state near to equilibrium; and in general we should expect them to stay there (moving away from equilibrium is moving from the more probable to the less probable). Occasionally these gases might evolve into less probable states away from equilibrium, but they are unlikely to move far from equilibrium and would be expected to return to equilibrium again given enough time. The expected entropy levels of such isolated systems over a long period of time is shown in figure 8.9.

The reality, however, is quite different. Any isolated system we are likely to come across will be in the same very low entropy state that everything in our part of the universe appears to be in. It may be true that these systems are moving towards equilibrium but they are still a puzzling distance away from it. The conflict could hardly be more extreme. On one

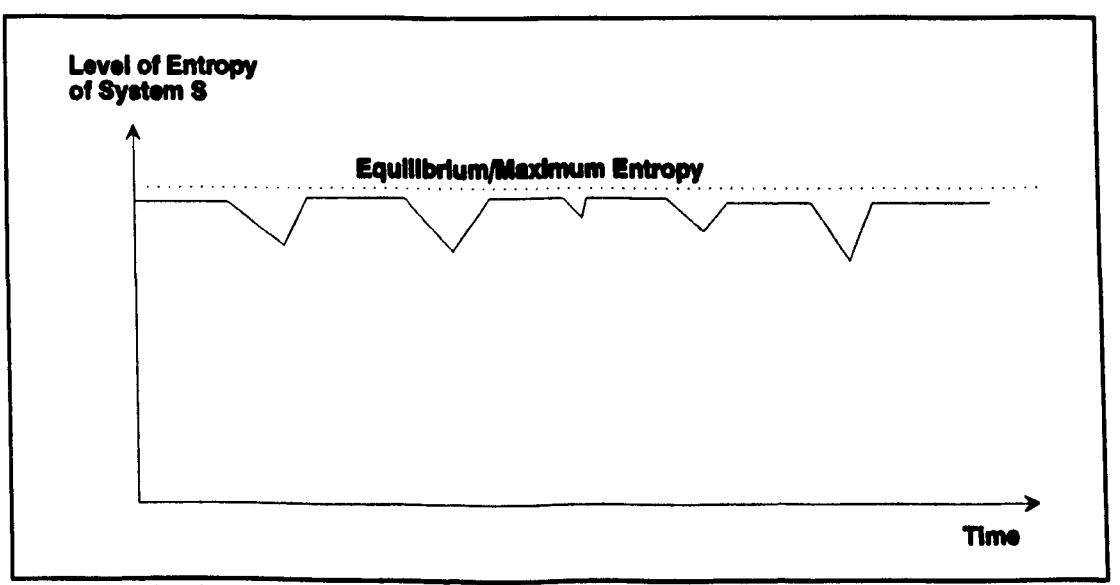

Figure 8.9. The change of entropy level of an isolated system over a long period of time

hand we have Boltzmann's statistical mechanics implying that most systems should be in a state near equilibrium and that in the long term their entropy level decreases as often as it increases. On the other hand, the reality is that

most systems we find are far from equilibrium and their entropy levels practically always increase.

In fact, the key puzzle is not so much why in reality entropy practically always increases: it is why it is so low. This is because the low level of entropy automatically entails that entropy will almost always increase. A useful analogy is a pack of cards arranged in suit order (see Horwich [1], p.67-8). Initially the pack could be said to have a very low entropy. Once the cards have been randomly shuffled they will be more disordered. This is simply because the number of disordered states that shuffling might produce far outweighs the number of ordered states. After the first shuffle the cards may still retain some order (perhaps the Ten, Jack, Queen and King of Hearts have remained together). But with each successive shuffle the cards will become more and more disordered. The situation with entropy is the same. Given an initial state of low entropy, random evolution (shuffling) will almost always lead to a higher entropy system.

So the really puzzling question is: *why is our particular region of the universe in such an unlikely state of low entropy?* Given that there is a state of low entropy, the statistical understanding of thermodynamic processes shows why entropy will almost always increase - this is simply the most probable way for things to develop. *But how did entropy come to be low in the first place?*

(ix) Why Was Entropy Low in the Past?

To explain why entropy was low in the past, Boltzmann appealed to what is called the *anthropic principle*. According to Boltzmann's statistical mechanics, it is very unlikely for any region of the universe to be in a state of low entropy. But although this state of low entropy is unlikely, it is not impossible. In fact, given enough time it is bound to happen. In the same way, the chances of winning the National Lottery are about 1 in 13 million. It would be very unlikely that I win it this week (especially as I don't have a ticket) but if I do it once a week for the next 13 million weeks, I stand a good chance of winning at least once. In other words, given enough goes I am bound to win eventually.

If space and time are infinite, then, there are bound to be places and times at which the entropy is very low. The question is why *we* find ourselves in such an unlikely region, when there are so many high entropy regions to "choose" from.

Boltzmann's answer is that we find ourselves in a low entropy region, because *low entropy is a necessary condition for the arising of intelligent life.* This is because things necessary for the evolution of life - stars, planets, etc - are all low entropy (or highly ordered) phenomena. It follows that whenever an intelligent life form investigates the entropy in the region of the universe where it exists, it will find the entropy to be very low.

This answers the question in one sense. It is not improbable that we are in a low entropy region, since if entropy wasn't low we wouldn't be here in the first place. But there are several problems. For one thing, the universe is much more unlikely that it needs to be to sustain intelligent life. There are a huge amount of more likely/higher entropy possible universes in which conditions would allow life. The anthropic principle mitigates the unlikeliness of our own universe a little, but the odds are still very puzzling. Another problem is simply the time requirement. Given enough time fluctuations into low entropy states are inevitable; but we know the universe has only existed for something like 15 billion years. 15 billion years is a long time, but statistically we would be likely to have to wait much longer before we were lucky enough to see milk and coffee spontaneously separating, or baths boiling at one end and freezing at the other.

A better answer might be found in modern cosmology. There could be a cosmological account of how such a low entropy region came about in the first place. For example, Horwich mentions that there have been speculations that pockets of low entropy were formed in the universe as a result of the rapid expansion following the Big Bang.

In general, cosmological theories postulate some sort of *boundary conditions* that obtain at the time of the Big Bang, related to factors such as the initial rate of expansion of the universe, the initial distribution and density of matter, etc, etc. Whatever the precise nature of these conditions, it may be that they explain why the early universe was in a very low entropy state. Therefore we can also see why we today are in a fairly low entropy state: entropy may have been increasing since the beginning of the universe, but it still has some way to go before reaching equilibrium.

Since a low entropy universe is very unlikely, the function of the initial boundary conditions can be seen as *overriding* the normal statistical improbability of low entropy. In other words, the influence of the boundary conditions is greater than the normal statistical considerations. This point will be useful in Chapter Nine, when discussing what I call the *symmetry* approach to the asymmetries we find in time.

(x) Entropy and the Direction of Time

As mentioned, a great weight is often placed on entropy in discussions about the direction of time. Entropy is sometimes thought to provide time with an intrinsic direction. This is via some sort of reduction of the relations "earlier than" and "later than" to facts about entropy increase. The claim is that this reduction gives us the genuine difference between these two relations that is needed to satisfy the first criteria of intrinsic direction (e.g. a non-arbitrary distinction between earlier and later). If this reduction worked, entropy would no longer be a content asymmetry: it would be constitutive of intrinsic direction.

The rough idea behind the "reduction" of earlier and later to facts about entropy increase is that the temporal relation of one state S(1) of a system being "earlier than" another state S(2) can be identified with a non-temporal relation R. This non-temporal relation R is related to entropy increase: R holds between S(1) and S(2) *if and only if the entropy of S(1) is lower than the entropy of S(2)*. "Identified" here means a kind of scientific identification, similar to the identification of salt to particular combinations and structures of chemicals. The reduction is not a more philosophical one, in which it would be held that the *meaning* of "earlier than" and "later than" somehow reduces to talk about entropy. This is too implausible: when I say that my lunch appointment is earlier than a lecture, there is no reference to increases in entropy. But it might just be thought that it is a scientific discovery about the world that these relations are identifiable with and reducible to matters about entropy.

But this idea will not work. Even setting aside general problems connected with any attempt to reduce "earlier" and "later" to some physical processes or relations, it seems clear that entropy cannot do the job. Consider the following three problems:

(i) According the above account of entropy, there is only a high probability that the entropy of a system will increase. This means that it is a least possible that entropy might decrease. Given sufficient time, there would definitely be occasions on which entropy stopped increasing and started to decrease (as in figure 8.9). *Would this mean that time starts to run backwards?*

(ii) It is conceivable to suppose that entropy levels can vary throughout the universe. Suppose that in some regions entropy was increasing, but in another region entropy was decreasing. This other region might be a high entropy region undergoing a fluctuation towards lower entropy. *Would this mean that the direction of time differs from region to region?*

(iii) Strictly speaking only isolated systems behave appropriately. As pointed out above, energy can be used to create local states of low entropy, even though overall (when the surroundings are taken into account) the entropy level will increase. If the direction of time is identifiable with entropy increase, then we should be able to determine which direction is earlier and which is later by studying the changes in entropy of an isolated system (or at least a nearly isolated system). But there is a problem: *which isolated system or set of isolated systems should we use to determine the time-direction?*

Taking this third problem first. Can the universe as a whole be regarded as an isolated system which is increasing in entropy? Sklar suggests that the notion of the entropy of the universe as a whole may not be well-defined. He writes:

> If the universe is infinite, and contains an infinite number of particles, then the notion of its total entropy is simply not well-defined, since the Boltzmann statistical notion [of entropy] is applicable only to finite systems" (Sklar [1], p.407)

In addition to this, we can only observe entropy changes in our own region of the universe. Even if the entropy of the universe is well-defined, is it possible to measure it? Clearly the universe is not in equilibrium, but it is equally likely that the entropy is decreasing as that it is increasing (i.e. in terms of figure 8.9, the universe as a whole could just as well be on a downward part of a "v" as on an upward part). *This seems to have the bizarre consequence that we can't be sure which direction is "earlier" and which is "later"!*

A possible answer is to use the notion of a *branch system*. A branch system is a system which initially is open to interaction with the rest of the

universe, but then "breaks off" and continues to evolve for a time in the same way as an (almost) isolated system. Eventually it may "rejoin" the rest of the universe (i.e. begin interacting with it again).

Reichenbach suggests that the direction of time should be identified with the direction in which a *majority* of these branch systems increase their entropy. This suggestion however seems to suffer from the same objections as above. If the universe is infinite, talk of a majority of branch systems may not make sense. There may be an infinite number of systems increasing entropy, and an infinite number decreasing: which is in the majority? Again, even if the notion of "majority" of branch systems is valid, we have no way of knowing what the majority are doing. We have access only to those in our local region of the universe. Once again this leaves us in doubt as to whether time is going forwards or backwards.

A final alternative is to assign a temporal direction to each branch system based on the direction of entropy increase in that particular system. This would make the direction of time a very variable quality. Time direction could change from region to region, or *even from system to system.* However, since in this local region of the universe all branch systems seem to be increasing in entropy, perhaps at least a *local direction of time* can be fixed using entropy increase.

This leads back to the second problem mentioned above, that of direction of time varying from region to region. John Earman objects to this, appealing to what he calls the Principle of Precedence. This states that:

> Assuming that space-time is temporally orientable, continuous timelike transport takes precedence over any method (based on entropy or the like) of fixing time direction "(Earman [1], p.22)

A "temporally orientable" spacetime is broadly one without any closed timelike loops and other extreme temporal peculiarities. Earman's principle means that if we know the time direction in one region (say our local one) then the time direction of other regions can be fixed by sending a signal or object along a timelike line (i.e. at a velocity less than light, within the forward light cone on a Minkowski diagram) towards that region.

Perhaps this can be made clearer by imagining that you are in a spaceship travelling at half the velocity of light towards a region in which entropy is decreasing. The direction along the timelike line you are tracing will fix the time direction in this region. Stages further along this line are "later"; stages nearer are "earlier". When you get to the region in which

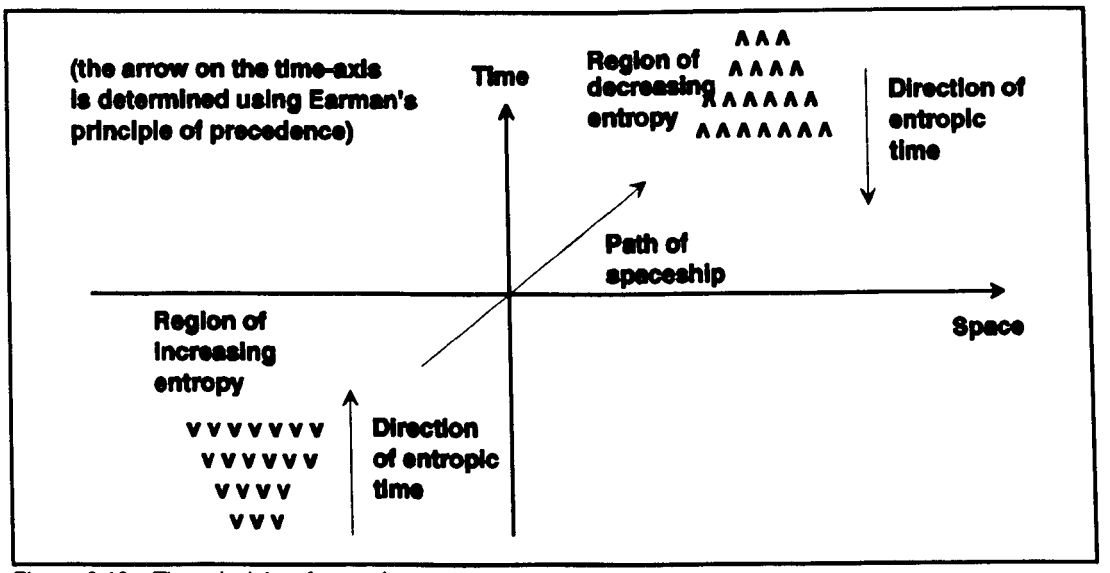

Figure 8.10. The principle of precedence

entropy is decreasing, Earman's method and the entropic method contradict each other. "Later" stages of your journey are actually "earlier" stages according to the entropic method. See figure 8.10. Earman's method seems intuitively more plausible than the entropic method and throws more doubt on the identification of entropy with time direction.

Finally what about the very first problem I mentioned (the fact that the identification of entropy with time direction seems to imply the possibility of the direction of time reversing)? Concentrating just on one branch system and taking the direction of entropy increase as the time direction of that system, what happens when the entropy begins to decrease? Call the state one second prior to the change of entropic direction S(1), which is at time t(x). Call the state one second "after" the change S(3), which is at time t(z). Call the state of the system at the moment of the change S(2), which is at time t(y). See figure 8.11.

Now according to the entropy method t(x) is earlier than t(y), since S(1) has a lower entropy than S(2). But t(z) is also earlier than t(y), since S(3) has a lower entropy than S(2), and entropy determines time direction. Intuitively this is awkward. *We would want to say that S(3) is a later stage in the evolution of the system than S(2) but the entropy method forces us to say that it is an earlier stage.*

In fact the entropy method seems to lead to a straightforward contradiction. It seems to imply that t(x) and t(z) are simultaneous. S(1) occurs at t(x), which is one second t(y), the time at which S(2) occurs. S(3) occurs at t(z). And t(z) is also one second before t(y), since time has been reversed. *So both S(1) and S(3) occur one second before t(y) i.e. both occur*

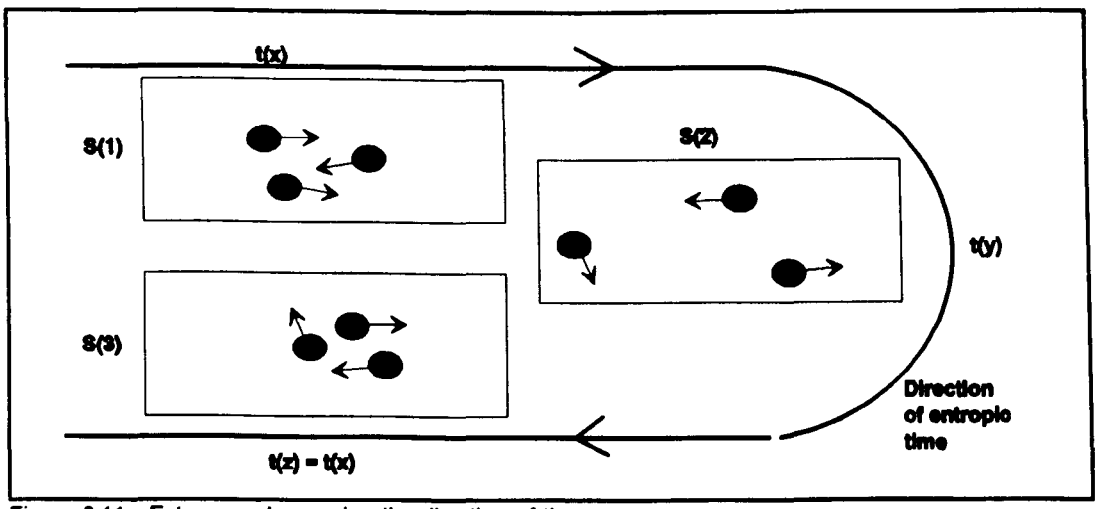

Figure 8.11. Entropy and reversing the direction of time

simultaneously. But S(1) and S(3) may well be incompatible states. There is no law to ensure that the way in which a system achieves entropy decreases must be the same as the way in which it achieved entropy increases. Even if the entropy of S(1) and S(3) are equal, this entropy level is realizable in any number of ways. But this implies that the system in question can be in incompatible states at the very same time, which is a straightforward contradiction.

This seems to show that one cannot identify the direction of time for a system with the direction of its entropy increase. The sensible thing to say is surely that S(3) happens after S(2) and S(1). In other words, despite the change in direction of entropy increase, time direction remains the same. And what goes for the individual system discussed above applies generally - time reversal inevitably leads to contradiction.

(xi) Summing up: Entropy and Intrinsic Direction

What can be concluded about the intrinsic asymmetry of time from the above discussion? We have seen that the possible fluctuations of entropy (and other problems) makes reducing earlier and later to variations in entropy an implausible idea, if not an outright contradiction.

To make matters worse, it seems that even if this had been successful the entropic approach to intrinsic direction fails to meet all three criteria for intrinsic direction. Some work has been done linking entropy to different asymmetries in time (see Horwich [1], pp. 11-12 which is a brief discussion of Reichenbach). Although I would argue against entropic explanations of many of the asymmetries, there is at least some chance that entropy could

meet the third criteria. The most difficult problem is with the second criteria: the need to provide a basis for a *preferred* direction.

I can see no way in which this problem might be solved. Just because entropy may usually increase with respect to one direction, but decrease with respect to the other, *no preference for either direction is shown.* At most an intrinsic "grain" would have been found in the way events are arranged in time. No reason is given to follow the grain in one direction rather than the other.

I conclude that the attempt to link entropy with the intrinsic direction of time is almost certainly doomed to failure.

(xii) Does Time Have an Intrinsic Direction?

This conclusion leads to something of a dilemma. I have looked at two possible accounts of intrinsic direction: the passage account and the entropic account. Neither of these accounts appear to work. Of the two, perhaps the passage account of direction comes closest, in so far as it at least addresses all three criteria of intrinsic direction. Should we conclude from this that, if time has an intrinsic and preferred direction, then this is because of passage?

I suggest that the real answer is to reject not only both of these accounts, but the whole idea that *time has an intrinsic direction.* Recall that the main reason for supposing that time had an intrinsic direction to begin with was the large number of content asymmetries we find all around us. In section (vi), when I argued that passage cannot explain all the content asymmetries, I suggested two alternatives. One was to look for some other account of intrinsic direction - account X - which could explain all the asymmetries. The material from section (vii) onwards was essentially an attempt to find a candidate for this mystery account X. The candidate suggested was entropy, but this was not really plausible.

The other alternative was to explain the asymmetries beginning with one or two very basic content asymmetries, which would have to be treated as brute matters of fact. The suggestions I made there were designed to show that passage was redundant when it came to explaining the asymmetries. *But the points made could just as well be taken to show that intrinsic direction is redundant.*

The main reason for supposing intrinsic asymmetry is to explain the content asymmetries, and none of the accounts offered can do this. Passage may be the best option. But given the many difficulties discussed, this is still

a poor choice. If the asymmetries in time can be explained resting only on a few fundamental brute asymmetries, why insist that time has an intrinsic direction and have to deal with the severe difficulties involved with this idea?

If time has no intrinsic direction, then there is no danger that the passage of time might be needed to account for it. In other words, the existence of so many pervasive asymmetries in time (causation, knowledge, value, etc) will raise no potential problems for the tenseless theory of time.

However, I am aware that to support this conclusion it is necessary to say more about exactly how the asymmetries can be explained without intrinsic direction. For this reason (and also because the topic is interesting in its own right) the next chapter will discuss the explanations of (and relationships between) the different content asymmetries.

Chapter Nine

Asymmetries Within Time

(i) Introduction

In this chapter I will be exploring some of the pervasive asymmetries in time, which I introduced near the start of the last chapter. It will soon become apparent that this area is tangled and confused. There are many varied ideas and arguments, but very little agreement.

The most promising way to approach this area is to concentrate on the *connections* between the different asymmetries, rather than trying to focus on them individually. The reason for this approach is that it is difficult to understand individual asymmetries in isolation. The explanation of any one asymmetry is likely to draw on others; and these in turn will be connected with still more basic asymmetries. The need for a combined treatment is stressed by Paul Horwich in particular:

> ... there is strikingly little agreement about the sources of temporally asymmetric phenomena and about the interdependencies among them. This is in some part because philosophers have tended to approach these questions in an overly piecemeal way. Consequently their conclusions are often undermined by a failure to appreciate and accommodate the needs of a comprehensive account. (Horwich [1], p.12)

I suggested in the last chapter that an explanatory map of the asymmetries that did not appeal to intrinsic direction could fit the general form: *root content asymmetry - physical asymmetries - human asymmetries.* In other words, one or two fundamental asymmetries explain the low level physical asymmetries such as forks and entropy which in turn explain higher level human asymmetries such as knowledge, decision, and action. To make this idea plausible I need to give some concrete, detailed examples.

Over the course of this chapter I will explore three main approaches, which might roughly be called the *causal* approach, the *knowledge* approach,

and the *symmetry* approach[40]. To some extent I will leave it an open question which approach is the best. My primary aim is to back up my suggestion that the asymmetries in time that we find around us do not need to be explained in terms of intrinsic direction. The discussion of these three approaches will help with this in three main ways:

(1) Each approach offers a concrete example of how the asymmetries can be explained without reference to intrinsic direction.

(2) Even if none of the accounts I suggest are free of problems, I hope to make it clear that they are more plausible than any account offered in terms of intrinsic direction or passage.

(3) Finally, I hope to show that the *resources* available to anyone explaining the asymmetries without intrinsic direction are plentiful. Even if none of the accounts I offer are on the right lines, there is plenty of scope for alternatives.

My secondary aim in this chapter is simply to explore how the asymmetries might be explained and how they are related, since this is a fascinating topic in its own right.

PART 1 - THE CAUSAL APPROACH

(ii) The Causal Explanatory Map

The first account of the asymmetries I will look at is the *causal* approach, so called because causation plays a pivotal role. See the two explanatory maps shown in figure 9.1 (a) and (b). (I will explain the reasons behind these different versions of the causal explanatory map in the course of my discussion.) In 9.1 (a) the causal asymmetry is taken as basic and unexplainable; in 9.1 (b) it is explained firstly in terms of forks and more distantly by initial conditions holding at the time of the Big Bang. Although causation is not the lowest level asymmetry in 9.1 (b), it still plays a key role, linking the human group of asymmetries to the physical.

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[40] What I call the knowledge approach is largely derived from ideas put forward by Paul Horwich. The symmetry approach is a result of selecting some key ideas from Huw Price's book "Time's Arrow and Archimedes' Point".

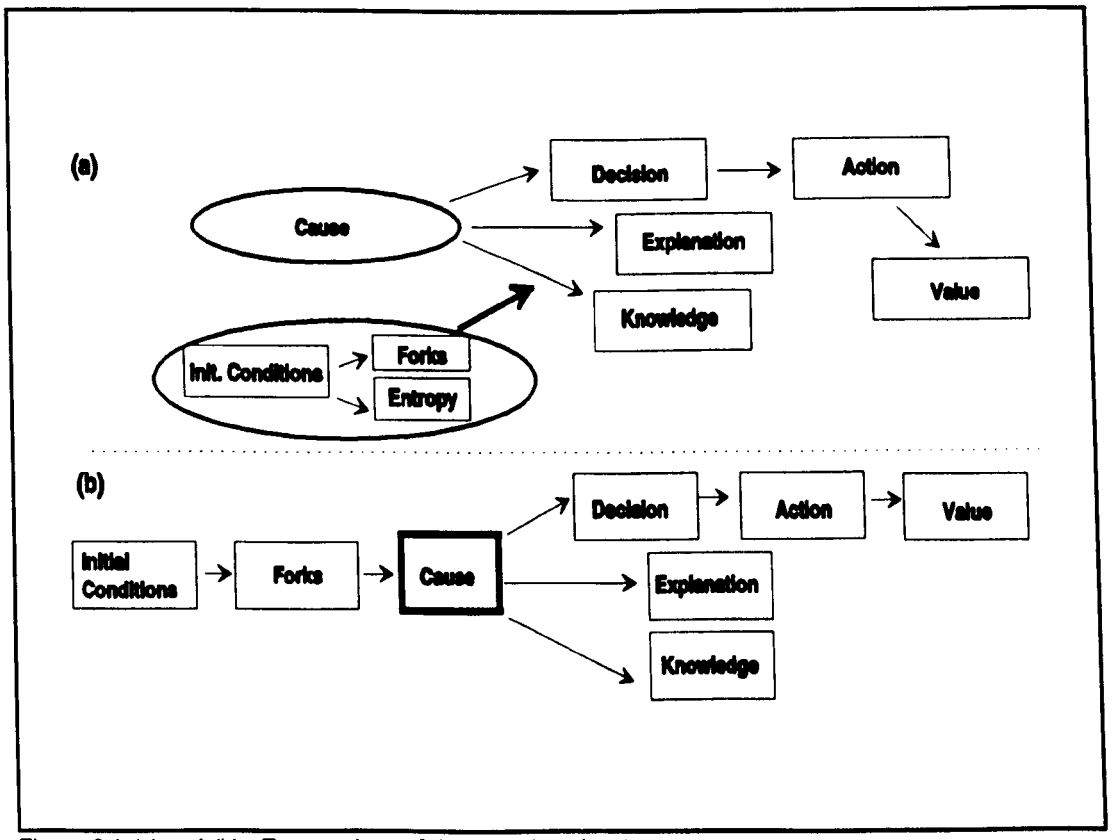

Figure 9.1 (a) and (b). Two versions of the causal explanatory map.

The motivation behind a causal approach is the recognition that the concept of causation appears to play an important role in concepts such as explanation, action, and knowledge. Since the causal explanation of these asymmetries is the most intuitive of the accounts I will offer only some brief suggestions. Some of these suggestions may be so brief as to sound implausible. My excuse is twofold. Firstly, I will be looking at the interconnections between higher level asymmetries in much more detail when I discuss the knowledge approach. Secondly, the most interesting and difficult question about the causal approach comes when we try to explain the causal asymmetry itself. Therefore it is this question that I will concentrate on.

Firstly, though, how might causation account for some of the higher level asymmetries? To begin with explanation, suppose that both last night and tonight there have been severe storms, full of thunder and lightning. I tell you that this afternoon I came across a fallen, blackened tree and ask you to explain what happened. You will probably realise that the tree was struck by lightning. But the important point here is the asymmetry that your explanation will show. You will probably say something like "the tree fell because it *was* struck by lightning *last night*". You will definitely *not* say "the tree fell because

it *will be* struck by lightning *tonight*'. Your explanation will show a clear asymmetry.

A natural suggestion about why this asymmetry exists draws on the causal asymmetry. To give an explanation of something is sometimes just to cite the causes responsible for bringing it about. Last night's lightning explains why the tree fell because the lightning is the *cause*. And since causes always precede their effects, it is obvious why the fallen tree is explained in terms of last night's lightning rather than tonight's: how could tonight's lightning cause a tree to fall this afternoon?

What about the asymmetries of action and decision? One sort of decision theory holds that it is only worth deciding to do something if there is reason to believe that the action chosen will *bring about* the desired results. Given this theory it is clear why decision is future-oriented. Actions bring about results in virtue of being causes. Since causes precede their effects, it follows that actions can only bring about *later* results. When I boil some potatoes in a pan, I do not expect my actions to bring it about that the potatoes were cooked half an hour ago. My actions of putting potatoes and water in a pan, turning on the heat, etc, are causes; cooked potatoes are the effect. It is because causes come before their effects that I cannot expect my actions to bring about earlier events, but only later ones.

The asymmetries of action and decision also offer some explanation of the value asymmetry (roughly, why we tend to be more concerned about future events than past events). A clear example is a game of squash. When your opponent is about to serve, you concentrate on winning the point ahead. You may regret losing the last point, but are most likely to transfer your energy and concentration to current point. One reason behind this is simply that your actions and decisions can make a real difference to the current point (and points to come); but can no longer affect the outcome of the previous point. In other words, *we tend to be more occupied with events that we can still potentially influence*[41].

(iii) Causation and the Knowledge Asymmetry

What about the asymmetry in our knowledge? To understand how causation can help we need a better understanding of what the knowledge

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[41] Obviously a great deal more needs to be said about this. But I hope the general approach to value in terms of the asymmetries of causation and action is clear.

asymmetry amounts to. The knowledge asymmetry is variously expressed by saying that we know more about the past than the future, or that it is easier to know about the past than the future. It is in fact quite hard to characterize the asymmetry precisely, although it clearly exists. Due to memory, to books and other records, to archaeological sites, and so on, we know a great deal of facts about the past that we don't know about the future. We know who the last ten Prime Ministers were, what kind of civilisation existed in Egypt three thousand years ago, and what kind of creatures roamed the Earth a million years ago. But we have little idea about similar facts that might hold fifty, two hundred, three thousand, or a million years into the future.

It will be useful to look at some examples of knowledge of the past and of the future. I will divide our knowledge into three main categories: *trace knowledge*, *knowledge based on prediction/retrodiction*, and *knowledge based on intention*.

Trace knowledge is very familiar. For example, I know that yesterday I went shopping. My knowledge in this case is based upon my *memory* of going shopping. My memory is essentially a *trace* of the past. Another example is my knowledge that England won the World Cup in 1966. I wasn't around in 1966 to see this for myself, but I have the testimony of people who were and of books and records in which this information is contained. I might even get hold of photographs or a video of the final. In other words, England's win in 1966 has left numerous *traces*, which allow me to gain knowledge about what happened. The situation is similar with archaeology and geology. There are traces of events in the distant past: artifacts, scrolls, cave paintings, fossil remains, etc. A great deal of the knowledge we have about the past depends on the existence of traces of one kind or another.

The most obvious example of *knowledge based on prediction and retrodiction* is knowledge about the motion of planets and other bodies in the solar system. Given enough data about the state of the solar system and given a set of laws, it is possible to both *predict* what state the solar system will be in at later times and *retrodict* what state the solar system was in at earlier times. Astronomers can tell us the next time we will see Halley's comet and also (without referring to past records) the last time and the time before that. So knowledge based on prediction and retrodiction can provide us with knowledge of both the past and the future.

Knowledge based on intention applies exclusively to the future. I know with a fair amount of certainty that I'm going to go for a walk later this evening because I have a firm intention to do so and it is unlikely that circumstances

will conspire to stop me. If it is in our power to bring about some future states, and if we have a strong intention to bring about one of these states, then we can know with reasonable certainty that future state will occur.

I think this provides a rough framework of relevant sorts of knowledge. *Prima facie* it can be seen why knowledge of the past outweighs knowledge of the future. Knowledge of the future is based on *what we can predict* or on *what we can control through our own actions and intentions*. Prediction is not easy: we either lack sufficient data, or are ignorant of relevant laws, or the situation is simply too complex for us to handle. As regards intention, there are many things we have little or no control over (e.g. the weather, the motion of the planets) so knowledge of this sort is severely limited.

But to help us gain knowledge of the past, we have access to a wealth of *traces* of the past - our own memories, books, archives, fossils. This suggests that the starting point for trying to understand the knowledge asymmetry is the existence of traces.

The causal asymmetry appears to be ideally suited to explain why there are traces of the past but not of the future. The reason is simply that traces are *caused* by the events they record, and must therefore come *after* these events. The footprint of a dinosaur was caused by the dinosaur walking over that area. Since causes precede their effects, footprints of creatures walking around a million years in the future are simply not available yet. The causal asymmetry therefore explains why there are traces of the past but not of the future. And the usefulness and prevalence of trace-knowledge, as opposed to knowledge based on prediction/retrodiction or intention, explains why our knowledge of the past outweighs our knowledge of the future.

(iv) A Priori Truth and Conventional Predetermination

In the above section I gave a rough outline of how the causal asymmetry could be used to explain the higher level asymmetries in explanation, action, decision, value and knowledge. I now want to work "down" the map to the lower level asymmetries that might underlie causation. This is a difficult question.

The question is made especially difficult by the fact that most accounts of causation are perfectly symmetrical in time. Suppose we take a fairly simple orthodox analysis of causation in terms of necessary and sufficient conditions. That is, a cause is an event which is both necessary and sufficient for its effect. For example, if I throw a brick through a window, my

throwing the brick is the cause of the window breaking. This is because the brick is sufficient for the window breaking (given that I threw the brick the window was bound to break) and necessary for the window breaking (if I hadn't thrown the brick the window wouldn't have broken)[42].

But note that this account of causation is symmetrical with respect to time. Suppose that my throwing of the brick is both necessary and sufficient for the breaking of the window. Since throwing the brick is sufficient for breaking the window, it follows that if the window didn't break, the brick couldn't have been thrown. So the window breaking is *necessary* for the brick throwing. And if the brick throwing is necessary for the window breaking, then it follows that if the window is broken it must have been the case that the brick was thrown. So the window breaking is *sufficient* for the throwing of the brick. So not only is the throwing of the brick necessary and sufficient for the breaking of the window, but the breaking of the window is necessary and sufficient for the throwing of the brick.

Since what we call the "cause" and what we call the "effect" are both necessary and sufficient for each other, what is the basis for calling the throwing of the brick the "cause"? Why do we treat the throwing of the brick as the causally prior event responsible for bringing the other event about?

One way to answer this question is to say that it is a necessary *a priori* truth that causes comes before their effects. This explains why causes comes before their effects, or at least *puts it beyond the need of further explanation.*

This answer in fact splits into two distinct versions. Firstly, it might be thought that the claim that causes precede their effects says something important and substantial about the way the world is. This version takes a rationalist approach to *a priori* truths, in which we can gain genuine insight into things by reason alone. Secondly, it might be thought that the claim is a matter of *convention* or *stipulation*. Horwich calls this the *conventional predetermination* view, since it is determined in advance and as a matter of convention that the cause is earlier than the effect. Put differently, it is simply part of our conventional definition of "cause" that causes are earlier than effects[43].

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[42] Anyone unfamiliar with this standard approach to causation can find a basic account in Taylor [2].

[43] Hume's account of causation puts time order in by stipulation. Hume writes that we "may define a cause to be an object, *followed by* another, and where all objects similar to the first are *followed by* objects similar to the second" (Hume [1], Section VII, part II, 60, my italics). Here "followed by" forms part of the definition of what a cause is, making it a logical truth that causes precede effects.

These answers have importantly different consequences for the causal explanatory map. If it is a substantial *a priori* truth that causes precede their effects, then the explanatory map will stop with causation in a root position. There is no more need to explain why causes precede their effects than there is to explain why two and two is four. This is perhaps a workable position: if it is a fundamental truth that causes precede their effects, then causation provides a firm basis on which to base the other asymmetries.

There is a slight problem with how to handle low level physical asymmetries like forks and entropy. Consider entropy first. There is no obvious explanation drawing on the fact that causes precede their effects that tells us why entropy (almost) always increases. As we have seen the explanation of this is complex and goes right back to the initial conditions at the beginning of the universe. As for forks, there is some connection between forks and causation. But as I will discuss later in the chapter, the fork asymmetry is also likely to go back to initial conditions holding at the time of the Big Bang. And if there is an explanatory link between the fork asymmetry and the causal asymmetry, it will be forks that explain causation, not vice-versa.

Not only are these low level asymmetries not explainable in terms of the causal asymmetry, there also appear to be explanatory links between forks and entropy and some of the higher order asymmetries such as explanation and knowledge. The most natural solution appears to me to be to allow that both the causal asymmetry, and the low level physical asymmetries have an influence on the higher level asymmetries. Causation is a fundamental asymmetry. Another fundamental asymmetry could be connected to the initial conditions obtaining at the time of the Big Bang: it is this asymmetry that underlies the low level physical asymmetries.

This would give us two fundamental asymmetries: causation and initial conditions. Both of these fundamental asymmetries will operate together to explain all the higher level asymmetries. If this is correct it leads to the explanatory map shown in figure 9.1 (a). (For the moment I am leaving the nature of the link between forks and entropy and the higher level asymmetries quite vague: I will discuss this matter in detail when I come to the knowledge approach).

In the present philosophical climate these kind of substantial *a priori* truths are liable to be seen as suspect. It is more likely that if it is an *a priori* that causes precede their effects then this will be understood as the conventional predetermination view: it is a matter of stipulation that causes

precede their effects. One thing that seems problematic with the conventional predetermination account is that there is an intuition that there must be some substantive difference between a cause and an effect, some difference that would enable us to determine which of the two is the cause and which the effect without having to know which is the earlier event. If it were a purely arbitrary matter of convention that the earlier of two causally connected events is the cause, there would be little wrong with calling the later event the "cause" instead. But instead it seems that there is something about the causal event which makes it correct to say that it brings about its effect, and this something is not simply an arbitrary convention. Thus although this answer explains why causes precede their effects, there is no real account of what causal priority consists in, if this priority is felt to be non-arbitrary.

This point is even more forceful in light of the role the causal asymmetry is supposed to play in the causal explanatory map. There *are* genuine asymmetries in action, knowledge, decision, explanation, etc. How could a merely arbitrary stipulation be responsible for these very real differences?

But both these answers face another more serious problem. In order to see the problem it will help to emphasize the distinction between the claim that causes precede their effects in time, from what might be called *causal priority*. Causal priority is roughly what it is about a cause that distinguishes it from its effect, making it the case that the cause "brings about" the effect rather than the other way around. The point I want to make over the next few pages is that causal priority is not automatically identical with precedence in time.

Causation is a fairly wide concept, wider than the "normal" sort of causation in which earlier events bring about a later one. A prime example of this is the conceivability of backwards causation (in which causes come *after* their effects). I shall discuss this later in the chapter. Another example is *timeless* causation, discussed by Richard Sorabji in his "Time, Creation and the Continuum" in a chapter exploring Platonist, Neo-Plationist and Medieval ideas about causation and time. Sorabji explains that one question discussed in ancient time is as follows.

Suppose that the universe has no beginning. Before every event there is another earlier one. The problem for some thinkers who found this view compelling was whether this could be reconciled with the belief that God created (or was causally responsible for) the universe. If the universe has no

beginning in time, God's act of creation could not have preceded the universe in time.

The solution is essentially to stress the distinction between what makes a cause "prior to" its effect from ideas about causes preceding effects in time. God's act of creation is *causally* prior to the universe in the sense that God "brings it about" that a beginningless universe exists. To put it differently, the existence of the universe "depends upon" God. This is quite different to the notion of God's act of creation preceding the universe in time.

I am not trying to defend timeless causation, only to point out that it is not obviously absurd. The point of this discussion is to stress that the notion of causal priority should be kept separate from the claim that causes always precede their effects in time. Causal priority refers to the idea that, of two causally related events, only one is the cause, and that it is the cause that "brings about" the effect. This doesn't automatically restrict causes to being *earlier* than their effects.

This separation of causal priority from precedence in time is fatal to the idea that it is a necessary *a priori* truth that causes precede their effects. To support the above argument I will now look at a more common way of separating causal priority from precedence in time i.e. the argument that backwards causation is conceivable.

(v) Backwards Causation

In his seminal paper "Bringing About the Past" Michael Dummett explores the idea of backwards causation. Dummett imagines a distant tribe with the following peculiar custom. Every year the young men who have just come of age go off on a lion hunt. They travel for two days, hunt, and then return. During the whole of this period the chieftain of the tribe (who has remained in the village) performs a ritual dance. This dance is designed to help the young men act bravely and make the hunt a success. Whatever may be thought about the likelihood of the chief's dance helping the young men, an extra strangeness is that the chief dances *even during the two days of the return journey.* This is odd because by this time the outcome is settled one way or another. Further dancing is a waste of energy. From our point of view all the chief can do during the last two days is sit and hope that the hunt was a success.

But Dummett's chief does not see things this way. During his many years as chief of the village he has found that dancing for the whole period

is correlated strongly with a successful hunt. And on those occasions where he stopped dancing for the last two days, the hunt tended to be a failure. Overall the chief feels that while dancing the full period is not 100% effective, it does make it significantly more likely that the hunt was successful.

From our point of view the chief is simply mistaken. We might acknowledge that there is a significant correlation between dancing the full period and a successful hunt, but we would probably feel that this was a coincidence or that there is an alternative explanation to backwards causation. Dummett's question is this: *what could be said to the chief to persuade him that the last two days' dancing could not possibly have any causal influence on the success of the hunt?*

The most promising strategy is generally known as the *bilking argument*. The idea is to get the chief to agree to an experiment. As soon as the hunt is completed we quickly let the chief know the result (by modern radio, or fast carrier pigeon). If the hunt was a success, then we ask the chief not to dance during the two days of the return journey. If the hunt was a failure, we ask that the chief does dance for the last two days. If the chief agrees and the experiment is carried out for the next few years, then there are three possible outcomes. Outcome (1) is what we would expect to happen. Outcomes (2) and (3) would surprise us but could in principle happen.

Outcome (1) If the chief is informed that the hunt was a success then he refrains from dancing the last two days as requested. But the hunt remains a success. And if the chief is informed that the hunt was a failure but continues dancing (again as requested) then the hunt remains a failure. If we perform this experiment often enough the chief will surely have to agree that dancing during the last two days has no effect. Dancing the last two days simply cannot change things. What this outcome will have done is destroy the correlation that the chief thought existed between dancing for the two days of the return journey and a successful hunt.

Outcome (2) When we let the chief know the result of the hunt, the rest of the experiment somehow falls flat. Suppose we tell the chief that the hunt has been a failure, and ask him to carry on dancing. For some reason he finds that he cannot dance: either he loses all his energy, or falls sick, or some serious incident (earthquake, war with a neighbouring tribe, etc) prevents him. Or we tell the chief that the hunt was a success, and ask him to stop dancing. For some reason he ignores us and carries on. Maybe he gets fed up with the experiment, or just has an overwhelmingly strong urge to dance. The strong correlation between dancing and a successful hunt remains intact, but at the cost of some strange coincidences.

Outcome (3) We let the chief know the result of the hunt, and he carries out the rest of the experiment as planned. Suppose we report the hunt to be a failure and the chief carries on dancing. Then when the young men finally get home it turns out that there has been a bit of a mix up. The hunt was really a success. Or we report that the hunt was a success and the chief stops dancing. But when the young men get home it turns out that the hunt was really a failure. Again, the correlation between dancing and a successful hunt remains intact, this time at the cost of persistently unreliable reports about the outcome of the hunt.

On the surface it seems that outcome (1) would force the chief to give up his belief in backwards causation. I will come back to this in a moment, but first I want to ask what would happen if outcomes (2) or (3) regularly occurred. Remember that the question being asked is whether backwards causation is logically possible. Outcomes (2) and (3) may be unlikely - but unlikely is not the same as logically impossible.

Suppose then that things turn out according to outcome (2) - what would this mean? Despite our best efforts the correlation between dancing for the full period and a successful hunt is not weakened. Whenever the hunt is a success the chief danced the last two days; and whenever it is a failure the chief didn't dance the last two days. But what has gone wrong? There are two distinct situations here - in one case the chief simply can't dance; in the other case external circumstances prevent him (see Horwich [1], p.93-96).

If the chief finds that he simply can't dance then we might agree that there is some sort of causal connection between the outcome of the hunt and the chief's dancing. *But we are likely to feel that it is the outcome of the hunt that is the cause, not the dancing.* Somehow the chief's ability to dance

depends on whether the hunt has been a success or not. The causal process involved is unusual, but at least it is oriented in the familiar *forwards* way.

But the chief may not be convinced by this. He might argue that the reason he couldn't dance was because of the bilking experiment. Perhaps feeling himself under too much pressure he couldn't really get himself going; or perhaps being part of an experiment made him try too hard. In this case *the fact that a bilking experiment is being carried out is responsible for the chief's inability to dance.* This seems bizarre to us - dancing is something that should be in the chief's power to do regardless of any experiments. But bizarre is not impossible. And if the chief believes this then he will not be disturbed by the outcome of the bilking experiment - it does not entail that he is wrong about the usual causal effect of his dancing.

What if external circumstances (earthquakes, local wars, etc) prevented the experiment from being properly carried out? Again this is very odd. If this happens every time we try the bilking experiment then there will be a *striking series of coincidences.* The chief may feel again that the fact that a bilking experiment is being carried out is again responsible for this; or he may agree that everything is just totally inexplicable, but shrug and say that that's just the way the world is sometimes. Either way the chief has been given no logically convincing reason to abandon his belief in backwards causation.

Suppose things turn out according to outcome (3). If this happened a few times or more it is likely that the chief would begin to feel that the information we gave him about the outcome of the hunt is not reliable. But every effort is made to make sure that the information is correct and in normal situations we would judge that the reports are reliable. This leads to the following bizarre situation - *information that would normally be taken to be reliable is cast under doubt by facts about whether the chief continues dancing or not.* From the chief's point of view, the correctness of the information is not independent from his own intentions about dancing.

As Dummett points out, this conflicts with our usual belief that our knowledge of the past is independent of any intention we have of acting in the future (or any actions we may perform). In other words, we believe that our evidence about what has happened in the past is not influenced by *what we are going to do.* Dummett's chief, however, can simply reject this belief. Given the frequency of outcome (3) he even has good reason to do this.

So if outcomes (2) or (3) happened enough times, the chief could quite happily hold onto his belief in backwards causation, though in each case at a cost. Either the bilking experiment must be taken to have an unexplained

influence over the chief's dancing, or there must be a series of coincidences, or reliable knowledge about the past must turn out to be unreliable.

But in fact he wouldn't be forced to give up his belief even if outcome (1) occurred. After a little thought the chief might reason that for any cause to have the appropriate effect there must be suitable background conditions[44]. Thus for his dancing to have any influence over the outcome of the hunt a certain set of background conditions C must also obtain (see Horwich [1], p.94). What if conducting the bilking experiment prevented C from obtaining? Backwards causation is probably a very delicate process and it needn't take much to prevent it from working.

It may seem odd that conducting the experiment should have any influence on how effective dancing is, but it is not impossible that it should[45]. Recall that it was assumed as part of the story that, *prior to the bilking experiment*, there is a strong correlation between dancing the full period and a successful hunt. It would not be that unreasonable for the chief to conclude that the bilking experiment ruins everything. But even if no connection between the experiment and the failure of the dancing could be found, the worse the chief would have to accept is a string of coincidences - it just so happens that whenever we try the bilking experiment it turns out to be one of those occasions on which the dancing doesn't work. After all, the chief never claimed that it was 100% effective. *The worst scenario is only to have to accept unlikely coincidences.* As Horwich writes:

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[44] For example, if my striking a match is the cause of a flame, one necessary background condition (usually taken for granted) is that there is *oxygen* around me.

[45] As an aside, it is interesting to note that at the microscopic level of atoms and elementary particles the disturbing effect of the bilking experiment is more readily understandable (see Price [1], pp.127-129). If someone claims that making event E occur backwardly causes earlier event F to have occurred, we can use the bilking strategy to try to refute them: observe whether event F occurs; if it does then try to prevent it; if it doesn't ensure that it takes place.

The key word here is *observe*. In order to conduct the experiment we must first observe whether F occurs. At the ordinary, familiar, macroscopic level this doesn't matter much. The effect of measurement of what is measured is negligible. But the point made familiar by quantum theory is that *at a microscopic level the act of observation must change what is observed.* At a microscopic level the changes caused by measurement will be profound. This means that after a measurement has been made it is very likely that the conditions necessary for the backwards causation of F by E have been disturbed. In other words, the bilking experiment simply cannot be carried out at a microscopic level.

> Why do the chief's actions not continue to have their 'normal' consequences? Why is it that his dancing fails to work (or proves unnecessary) precisely on the occasions when the bilking policy is in effect? How, in other words, can we explain the coincidence of (1) the bilking policy and (2) a combination of the absence of circumstances that are appropriate for the dancing to cause bravery and the presence of phenomena that will bring about bravery when the chief doesn't dance. We are left, it seems, with an embarrassing uncaused correlation - an inexplicable coincidence (Horwich [1], p.94)

But while this may be embarrassing it is not contradictory.

So it seems that, whatever the outcome, we are unable to prove to the chief that it is impossible to causally affect earlier events. A combination of the chief's willingness to entertain unusual beliefs and the existence of some strange, coincidental circumstances means that a "backwards" causal influence exerted by the dancing over the outcome of the hunt, is a possible option. Backwards causation does not seem to be automatically ruled out. All that has been shown is that from our normal perspective it must be a strange affair. This is summarised in the table below.

(vi) Tachyons and Backwards Causation

The bilking argument can in fact be made much more watertight. In the above discussion it might be thought that the presence of human beings - and particularly human beings with bizarre beliefs - muddles the argument. Just because the chief could not be convinced of the logical impossibility of backwards causation it may not mean that it really is possible.

The following example (see Horwich [1], p.102-3) appears to strip the problem to its bare essentials. Suppose that there are particles - usually called *tachyons* - which are capable of moving faster than the speed of light[46]. Using the apparatus of Special Relativity an example of backwards causation can be constructed. See figure 9.2. The tachyon leaves a laboratory at O and travels (faster than light) to a receiver at P. The receiver at P then emits a tachyon which travels to the laboratory at Q. The second tachyon can be calculated to arrive at a time *earlier* than the original tachyon left.

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[46] This need not conflict with Einstein's theories about nothing going faster than light: the loophole is that tachyons must be supposed to have no mass.

THE BILKING ARGUMENT

OUTCOME	CORRELATION MAINTAINED?	COST
Bilking experiment performed properly and has expected outcome: a report of success is followed by not dancing, and a report of failure is followed by dancing. In neither case does the dancing (not dancing) make any difference	✗	The bilking experiment must be supposed to have an unexplained influence over the mechanism of backwards causation **OR** There must be a series of unlikely coincidences
The bilking experiment is not properly performed. Even after a report of success the chief still dances; and even after a report of failure the chief doesn't dance. Either the chief finds he has no power over his own dancing, or external circumstances disrupt the experiment.	✓	The bilking experiment must be supposed to have an unexplained influence over the chief's power to dance **OR** As a matter of coincidence, bilking and the chief's inability to control his own dancing always coincide **OR** As a matter of coincidence, bilking and extreme external circumstances always coincide
The bilking experiment is performed properly. But it later turns out that the information given to the chief about the outcome of the hunt was incorrect.	✓	The reliability of knowledge of the past, no matter how carefully gathered, depends upon the chief's intentions about dancing

Now suppose that the laboratory is programmed to emit a tachyon at O towards P. But it is also programmed to self-destruct if it receives a tachyon from P at Q. This means that if a tachyon is sent from O, a tachyon

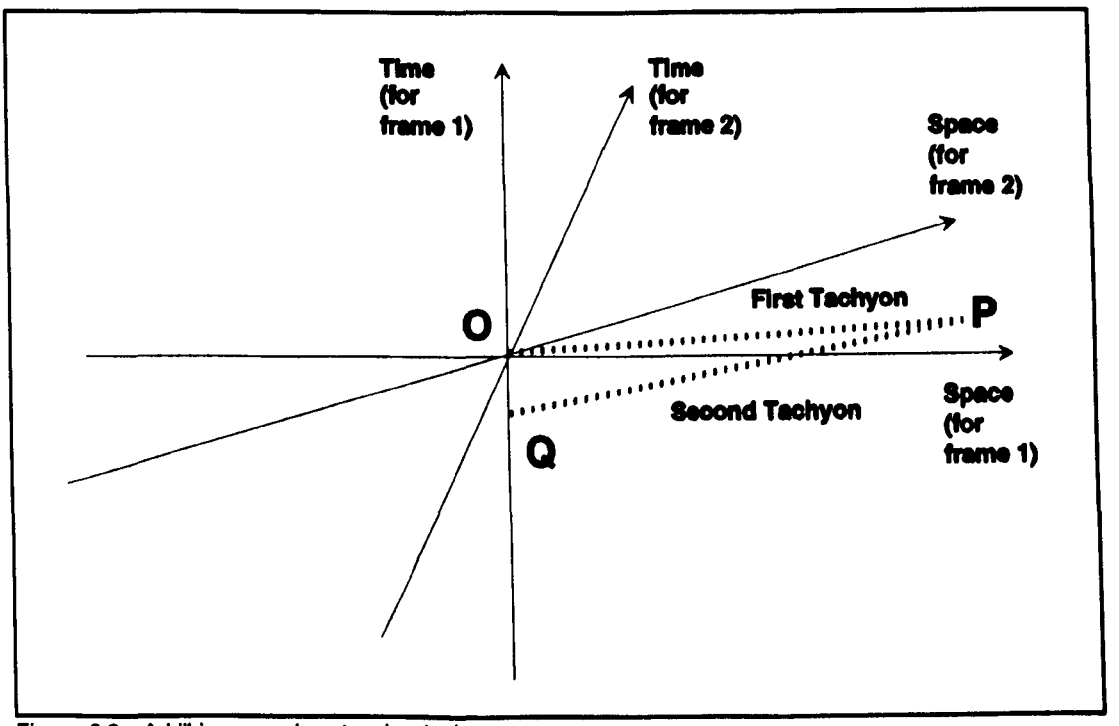

Figure 9.2. A bilking experiment using tachyons

will be received at Q; the laboratory will be destroyed and so no tachyon is sent from O after all. If on the other hand a tachyon is sent from O, no tachyon will be received at Q; therefore the laboratory will not be destroyed, and so a tachyon will be sent from O. So if a tachyon is sent from O, it isn't; and if it isn't, it is!

This example appears to yield a straightforward contradiction, with the added advantage of avoiding the complications involved with human beings (free will, knowledge, etc). But despite the apparently watertight contradiction, there are many ways to *avoid* contradiction. Some of the same considerations used by Dummett's chief also apply here. One outcome might be that the laboratory program malfunctions in some way. Either it fails to register the incoming tachyon, or it fails to self-destruct when it does. This may be a very unlikely and coincidental outcome (we can suppose that the laboratory is designed to be utterly foolproof) but it is just possible. Another outcome is that no tachyon is emitted from O since the laboratory self-destructed after receiving a tachyon at Q. But then where did the tachyon at Q come from? We have to suppose another unlikely coincidence - a tachyon

aimlessly wandering the universe just happened to come along from P to Q at the opportune moment. A third option is that a tachyon is emitted from O, and another one sent from P towards Q. But this second tachyon may be somehow intercepted or diverted - perhaps another opportune tachyon collides with it.

However unlikely these outcomes are, they are possible. Because of this no contradiction can be deduced from even this strong version of the bilking argument. Once again, backwards causation may involve many strange events, but not impossible ones.

(vii) Causation and the Fork Asymmetry

The purpose of the above discussion was to show that the close alignment of the causal arrow with the earlier-to-later direction of time is not a necessary truth. It *is* conceivable for causes to occur later than their effects. This conflicts with both the substantial *a priori* view and the conventional predetermination view.

But if both these views are wrong, why should it (almost always) be the case that causes precede their effects? What makes causes "prior to" their effects and why is this priority so closely aligned with temporal priority? This is by no means an easy question to answer. The most common response, which is suggested in different ways by many philosophers (such as Hans Reichenbach, David Owens, Paul Horwich) is roughly[47] that the causal asymmetry can be explained in terms of the *fork* asymmetry I mentioned briefly in Chapter Eight. If causation can be explained in terms of forks, this brings us close to the explanatory map shown in 9.1 (a). I will discuss how the fork asymmetry might be explained in terms of initial conditions holding at the time of the Big Bang when I come to the knowledge approach shortly. For the moment we can just assume that this works and add this last detail to complete the map in 9.1 (a).

A characterization of the fork asymmetry is sometimes given as follows: correlated events have common causes but do not have joint effects. Striking a match produces both heat and light. When the factory horn sounds at 5 p.m. all the workers lay down tools and the pigeons on the roof fly away in a brief panic at the noise. These kind of forks - in which two later events are

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[47] I say "roughly" since each of the philosophers mentioned would probably feel the need to qualify to some extent my statement that they explain the causal asymmetry in terms of forks.

associated with a single earlier event - appear to be quite common. The reverse case - where two earlier causes are associated with a single later effect - appears to be rare. The only examples seems to be unusual situations such as a man who is simultaneously shot and struck by lightning, each of which is independently capable of killing him[48].

For present purposes, however, this characterisation will not do. This is because we are trying to use the fork asymmetry to explain the causal

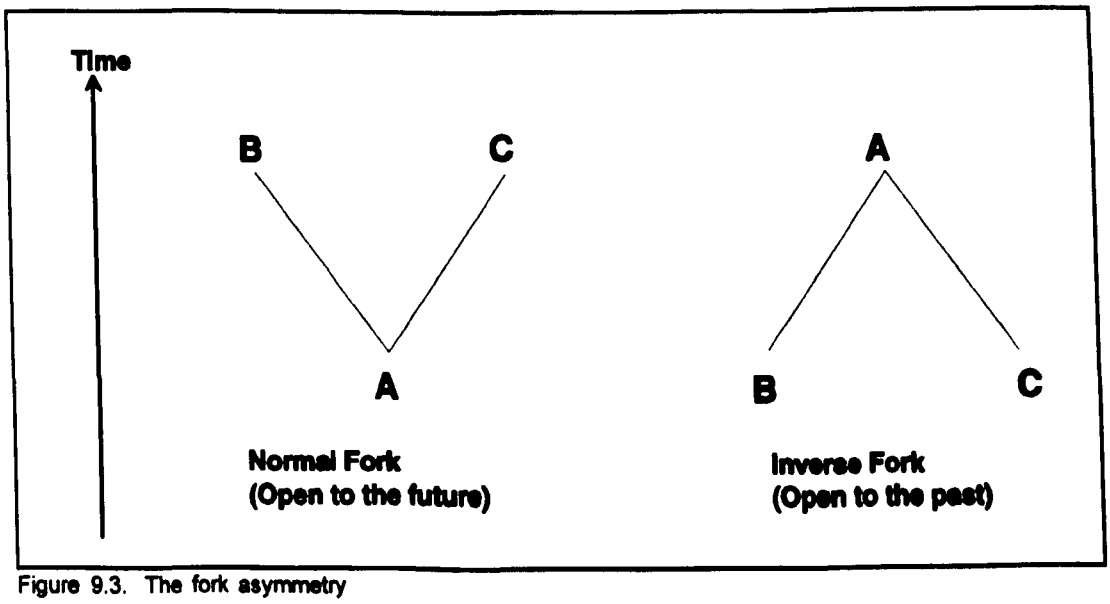

Figure 9.3. The fork asymmetry

asymmetry: therefore we cannot use the concept of causation in defining what forks are. The fork asymmetry is explained more usefully in terms of the kind of patterns in which correlated events tend to appear. The (earlier) striking of the match is found to be correlated with the (later) heat and the (later) light. These three events therefore fall into a "normal fork" pattern (see figure 9.3). The asymmetry involved with forks is that while this pattern is often found, it is rare to find events correlated in an "inverse fork" pattern. In other words, we do not often find that two earlier events are correlated with a single later event.

Now that the fork asymmetry has been outlined in non-causal terms, it can be used to help account for the asymmetry in causation. The general idea used is that causes should *explain* their effects, and that an explanation running from the event at the vertex of a fork to the events at the two ends is much better than an explanation running from the two ends to the vertex.

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[48] The qualification mentioned in Chapter Eight is that inverse forks do sometimes occur (especially where intelligent creatures are involved) *so long as this inverse fork follows on from an earlier normal fork*. So, for example, if two people simultaneously strain to produce a common effect (the lifting of a sofa) this will "follow on" from an earlier normal fork such as both people simultaneously heard the command to "lift".

I will expand on this later. For now I will just remark that the reason behind this is that an explanation of the form *vertex-ends* explains two phenomena in terms of only one, whereas an explanation of the form *ends-vertex* only explains one phenomena and at the cost of *two.*

Since it is the event at the vertex which explains the end events, it is the vertex event that is causally prior. The prevalence of normal forks (in which the vertex event is earlier than the two end events) over inverse forks (in which the vertex event is later than the two end events) therefore accounts for why causes are (almost always) earlier than their effects.

Whatever the merit of this idea (and I will explore it in detail during my discussion of the knowledge approach to the asymmetries) and in whatever form the fully worked out version of it takes, it is unfortunately at odds with the causal explanatory map I have been looking at. The reason is that the asymmetry of causation is only accounted for by the forks *via the stepping stone of explanation.* It is only because forks make explanation biased with respect to time that causes (which have to explain their effects) are seen to come before their effects. In other words, the order of explanation is: *fork asymmetry - explanatory asymmetry - causal asymmetry.*

But the explanatory asymmetry cannot underlie the causal asymmetry: in the causal explanatory map, explanation appears at a higher level than causation. And things get worse. It is not implausible (as we shall see later) to argue that the knowledge asymmetry has a role to play in accounting for the explanatory asymmetry as well as forks. Roughly, this is because we tend to explain unknown things in terms of the known. Because of the knowledge asymmetry (we know more about the past than the future) this suggests that we are likely to explain future events with reference to past events (what will happen in terms of what has already happened). If this is so, knowledge will appear at a lower level than both explanation and causation, despite the fact that in the causal explanatory map it appears above causation.

(viii) The Causal Approach: Summing Up

The discussion appears to have led to some serious difficulties with the causal approach. In trying to explain the causal asymmetry itself, three suggestions have come to light:

(1) The claim that causes precede their effects is a substantial *a priori* truth.

(2) The claim that causes precede their effects is a stipulation, a matter of conventional predetermination.

(3) The claim that causes precede their effects rests upon the fork asymmetry.

The problem with both (1) and (2) was simply that it does not seem that the claim that causes precede their effects is a necessary *a priori* truth: backwards causation is conceivable. Otherwise (1) would be ideal in the sense that the causal asymmetry would simply not be in need of any further explanation. As a matter of necessity it is the way things are. Causation could therefore be used as a *root* asymmetry in an explanatory map.

Option (3) was the only striking candidate for a more substantial account of the causal asymmetry, but as we have seen this raises problems. Forks only appear to underlie causation *via explanation*. And knowledge appears to share part of the burden of accounting for explanation with forks. This begins to destroy the whole order of the causal explanatory map.

What is really needed is a substantial account of the causal asymmetry, like that offered by forks, that nevertheless preserves the general order of the explanatory map. I will not make any more suggestions here, but the task seems possible in principle. However, I will now leave the causal approach and turn to an alternative way of looking at things.

PART 2 - THE KNOWLEDGE APPROACH

(ix) The Knowledge Explanatory Map

The next approach I will look at puts the knowledge asymmetry in a central position. The explanation of the asymmetries offered by Paul Horwich is an excellent example of this approach. The explanatory map he works towards was shown in Chapter Eight (in figure 8.5). Horwich's account is very intricate and detailed and it would not be possible to do it full justice here. In this part of the chapter I will therefore look at the simplified version of Horwich's map, shown in figure 9.4.

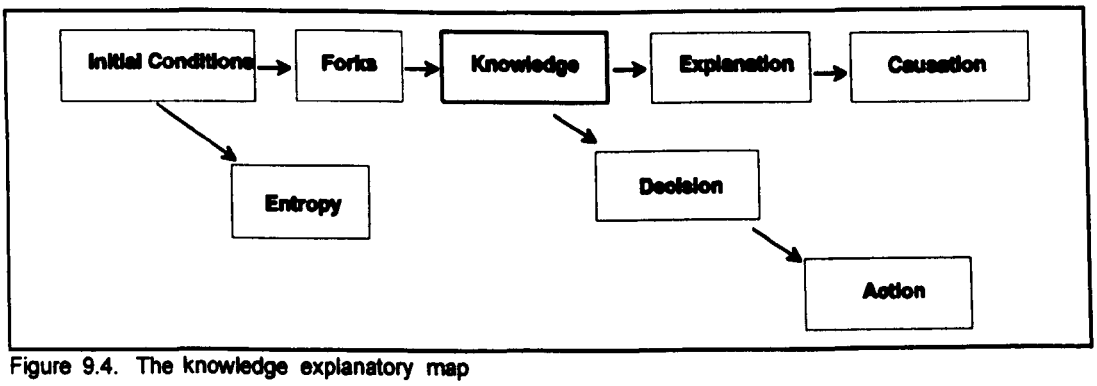

Figure 9.4. The knowledge explanatory map

Proceeding in the same that I did with the causal explanatory map, I will first work "up" the map from knowledge to higher-level asymmetries. Once I have done this I will then try to find an explanation of the knowledge asymmetry itself and work "down" the map back to the initial conditions obtaining at the time of the Big Bang.

(x) Decision

On the causal approach, the asymmetry of decision was held to rest on the causal asymmetry. This is due to what Horwich calls the orthodox *causal theory* of decision, which holds that it is worth deciding to do something if there is reason to believe that the action chosen will *bring about* the desired results. Since present actions and causes can only bring about things at a later time, our decisions always concern how we can change the future.

In Horwich's account, however, decision has a more basic role to play. The asymmetry of decision *underlies* the causal asymmetry rather than vice versa. Because of this the decision cannot be explained using causal considerations. Horwich therefore suggests an *evidential* account[49]. The rough idea is that it is worthwhile to perform an action if that action would count as *evidence* for the desired results coming about. More precisely, the evidential principle underlying the process of decision is something like:

> ... for every act under consideration, multiply the desirability of each alternative eventuality by its probability relative to the act in question, and add these products together, thus obtaining the act's expected desirability; then perform the act with the greatest. (Horwich [1], p.177)

[49] The key example in the debate between the evidential and causal views is *Newcomb's Problem*. For a statement of this problem see Horwich [1], p.178.

The key point in the present context is that an attempt is made to assess the *probability* of each outcome, given that the appropriate action is performed. In other words, to what degree would the appropriate action be *evidence* for each outcome?

This suggests two questions. Firstly, is the evidential account defensible? Secondly, given this account, what is the source of any asymmetry? As it turns out, looking at counterexamples to the evidential account provides the clue to the source of the asymmetry. Roughly, Horwich agrees with the suggestion I gave in Chapter Nine that it is impossible to decide whether or not to do something and at the same time to *know clearly* that one is not going to do it. But Horwich makes this idea much more precise.

A classic counterexample is to do with smoking. Suppose that there is a high correlation between smoking and cancer. Smoking would then be evidence for cancer i.e. my getting cancer (C) is more probable relative to the fact that I smoke (A). If the probability of getting cancer if I don't smoke is $P(C/\neg A)$, and the probability of getting cancer given that I smoke is $P(C/A)$, then the correlation means that $P(C/A)$ is very much greater than ($>>$) $P(C/\neg A)$. The evidential account therefore entails that smoking should be avoided.

But now suppose that smoking and cancer are linked due to some other common element - a genetic disorder - which is responsible for *both the tendency to smoke and the tendency to get cancer.* In this case it is pointless not to smoke, since my inclination to do so suggests that I have the genetic disorder anyway. I will have a tendency to get cancer regardless of whether I actually smoke or not. But since $P(C/A) >> P(C/\neg A)$ the evidential account still entails that I shouldn't smoke.

The usual reply, Horwich says, is to introduce the idea of what he calls *information screens.* A simple example is as follows. Consider these three states of affairs: X = the car battery is flat, Y = no electricity enters the radio, Z = the car radio won't work. The causal chain in this case runs from X to Y to Z. If we have reliable knowledge that no electricity has entered the radio (Y), then we can deduce that the battery is flat (X). Knowledge about Z is neither here nor there - if we know Y then we do not need to know Z. So Y has the effect of *screening off* the value of knowing Z.

Something similar applies in the smoking example. In this case there are four states of affairs: W = I have the genetic disorder, X = I have a tendency to get cancer, Y = I have a tendency to want to smoke, and Z = I

do in fact smoke. There are two causal chains here, one from W to X, and one from W to Y to Z. If I recognize in myself the inclination to smoke (i.e. have knowledge of Y) then I can conclude that I have the genetic disorder W. Y will have the effect of *screening off* any value that knowledge of Z might have. Once I know Y, Z can bring no further evidential implications. In other words, given knowledge of Y, $P(C/Z) = P(C/\neg Z)$. So the evidential account yields the right conclusion that in this situation it makes no difference whether I smoke or not.

How does this help understand the asymmetry of decision? The idea seems to be this (see Horwich [1], p.204-5). Suppose I want to have a drink of water. Experience tells me that there is a strong correlation between turning on the tap with my glass underneath it (A) and having a drink (B). Since $P(B/A) >> P(B/\neg A)$, it makes sense to do A. But suppose that I want to make it the case that I had a drink five minutes ago (X). However, I have a clear recollection (Y) that I didn't have a drink. I may try to make a list of potential actions A(1), A(2), ... , A(n) that might help me bring about X. The causal chain here would be X (my drink) to Y (my recollection) and then to one of the actions A(1) etc. First I don't drink water, this causes me to remember not drinking water, and this memory is a causal factor in my decisions about what action to perform. But Y (my knowledge that I didn't have a drink) allows me to deduce X (that I didn't have a drink). So Y acts as a screen that destroys any evidential implications that A(1) or A(2) ... or A(n) would have. In other words, given Y, $P(X/A(1)) = P(X/A(2)) = ... = P(X/A(n))$. None of my actions make it any more likely that I would have had a drink, so there is no point in performing any of them.

The key element in all this is of course the knowledge asymmetry. Because I know I didn't have a drink all possible actions are equally pointless. When I want to have a *future* drink of water, there is no knowledge to screen out the effects of doing certain actions. I realize that putting my cup under the tap and turning the tap on raises the likelihood of my drinking water, so I have good reason to do this.

This future-directedness of decision will now naturally spill over into action. My actions are a result of my decisions, and all my decisions are future-oriented. Hence all my actions will also be future-oriented, designed to bring about results at later times.

(xi) Causation

I argued in the first part of this chapter that *conventional predetermination* does not adequately explain why causes precede their effects. The discussion of backwards causation (and other points) showed that this question needs a more substantive answer than simply *stipulating* that the cause is the earlier of two causally connected events. The answer Horwich offers is a curious mix which he calls *nonconventional predetermination*. He tries to make this clearer by separating out two questions. Firstly there is the question of why causes generally precede their effects. But secondly there is the question of *why* we believe this i.e. *on what grounds do we maintain* that causes generally precede their effects?

For the answer to the first question, Horwich believes that conventional predetermination is right. Causes precede their effects because that is what we stipulate[50]. Implicit in this idea is the view that there is no genuine distinction between causes and effects in the physical world. Events may be causally related, but if so this is a symmetric relation. The fact that the earlier event is the cause is simply a matter of what we as human beings stipulate. I will come back to this point shortly.

Horwich stresses however that this stipulation is not arbitrary. We have substantive reasons for making the cause the earlier of two connected events. Although we *predetermine* that the cause is the earlier, this predetermination is *nonconventional*. This idea has advantages over the traditional conventional predetermination. The most important of these is that the stipulation is *a posteriori* not *a priori*. This allows predetermination to be compatible with the *conceivability* of backwards causation. Since it is not an *a priori* truth that causes always precede their effects, backwards causation is a logical possibility. Nonconventional predetermination is committed only to the view that there are *in fact* no cases of backwards causation[51].

But what are the *substantive* reasons for making this stipulation? Horwich appeals to a *cluster of maxims* which we typically accept, each of which has a contribution to make. Some maxims could be:

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[50] Horwich in fact argues for a more sophisticated stipulation, to allow for occasional cases of simultaneous causation. But I will not explore these refinements here.

[51] Perhaps the best way to make this clear is to reflect that if cases of backwards causation were discovered, then the *a posteriori* stipulation would have to be dropped (or altered). Since the stipulation is made *a posteriori*, based on what we know about the universe, it is always subject to new discoveries. This means there is no problem dropping or altering it.

(1) Causes should *explain* their effects.

(2) Causes are the *means* by which we bring about the effects which are our *ends*.

(3) Causes are ontologically more basic than their effects.

I will concentrate mainly on maxim (1). First, though, I will say a little about (2) and (3) in the next section.

(xii) Manipulability and Other Maxims

Taking maxim (2) first, the general idea is that the asymmetries of decision and action underlie the causal asymmetry. As Horwich writes:

> "Causation" is defined through its association with our experience of deliberation and control. More specifically, we define causation as that general relation between events that is exemplified when an event is deliberately brought about by free choice. (Horwich [1], p.143)

Huw Price also defends this idea, by appealing to the *manipulability theory* of causation. Roughly the idea is that our notion of causation is dependent on our experience as agents in the world. A cause is defined as an event which, if we could produce it, would result in some other (desired) event also occurring. In other words, causes are *means* and effects are *ends*. From these means and ends we can build up the wider concept of causation. The wider concept may be rooted in human action, but is usually given a more neutral, agent-free formulation.

These suggestions help supply causation with a direction. I have already discussed how the knowledge asymmetry can explain the asymmetry of decision (and therefore action). The link between causation, decision and action will ensure that the asymmetry "spills over" into our concept of causation.

Maxim (3), that causes are more ontologically basic than their effects, derives from the knowledge asymmetry more directly. According to Horwich:

> "Causation" is defined, in part, by the idea that a cause is in some sense 'ontologically more basic' than its effects. But, because of the knowledge asymmetry - very roughly speaking, the past is knowable and the future is not - we tend to think that the past has 'more reality' than the future ... And this leads to the idea that the past is causally prior to the future. (Horwich [1], p.145)

I will have occasion to come back to this idea that the knowledge asymmetry is connected with the differing degrees of ontological reality we attribute to the past and future. However, at this point, having done little more than mentioned two factors that might underlie the causal asymmetry, I will turn to maxim (1) in much more detail.

(xiii) Explanation

In order to see how maxim (1) introduces an asymmetry into causation we first need to look at the asymmetry of explanation. Note first that not all explanations are causal explanations (i.e. explanations in term of causes and effects). As Horwich writes:

> Explanation often takes place in noncausal domains. For example, the principle of utility might be proposed as an explanation of why it is wrong to hurt people; the syntactic constraint, "reflexives must be bound within their own clauses," tells us why "John want Mary to like himself" is ungrammatical; the laws of probability explain why a large random sample is usually representative of its population ... (Horwich [1], p.155)

In these noncausal areas explanatory priority is clearly distinct from temporal priority. Rules of grammar and ethics explain why a sentence is ungrammatical or an action is wrong, but it is peculiar to speak of these rules having to precede the ungrammatical sentence or wrongful action in time. But on a causal level, explaining why certain events take place, there is a marked asymmetry with respect to time. We say that the window was broken *because* a brick was thrown at it. It is the throwing of the brick that explains the broken window, and not the other way round.

The classic account of explanation is Hempel's *deductive-nomological* model. The rough idea is that event E can be used to explain event F if given that E has occurred we can *deduce* that F must also occur using facts about

the current situation and *laws of nature*. The thrown brick explains the broken window because given that the brick is thrown, and given the background situation (other relevant conditions) and certain laws of nature (about gravity and collisions etc), it deductively follows that the window will be broken.

A problem is that this account appears to be symmetrical with respect to time. The usual example given is a flagpole which casts a shadow on the ground. Using facts about the situation and the laws of nature the explanation runs both ways. The length and thickness of the flagpole explains (in conjunction with the angle of the sun, etc) what sort of shadow will appear on the ground. But equally the shape of the shadow explains (on Hempel's analysis) why the flagpole has the shape that it does - and even why the sun is at the angle that it is! The difficulty lies in the fact that the laws of nature are for the most part symmetrical. Because of this, deduction from a given state of affairs can run both ways equally well.

The symmetry of Hempel's account suggests that it will not help us much in the search for the source of the asymmetry of explanation. Since this symmetry is a serious problem with Hempel's account, it will be best to leave it to one side. Rather than offering a different account, it may be more useful to look at some general points about what we do when we explain things.

One point is that a good explanation should ideally explain things that we don't understand in terms of things that we do. In other words, the direction of explanation runs from the more simple and basic to the more complex and obscure. As Horwich writes:

> Given any domain of inquiry, we expect there to be a relatively small set of simple principles that logically entail all other facts in the domain. These are regarded as the most basic facts ... Very crudely, we say that P is more basic than Q if the simplest deduction of Q from the core of most basic facts 'passes' through P ... (Horwich [1], p.155)

Connected with this idea of simplicity is the notion of the unifying power of an explanation. A good explanation explains a wide diversity of phenomenon in terms of a few simple basic facts. When Spinoza writes that all activity of a worldly sort is directed towards the three goals of money, power and fame, he is potentially offered a powerful explanation of a great diversity of human actions. Good explanations explain complex facts in terms of simpler facts; and *unify* a diversity of complex facts by accounting for them all in the same simpler terms.

Moving away from these general features of any kind of explanation, what we are particularly interested in are explanations of the things which happen around us in terms of cause and effect. That is, explanations like: "the window broke *because* someone threw a brick at it", "I got soaking wet walking home *because* it was pouring down with rain". I will call explanations of this sort *causal explanations.*

The idea that a good explanation explains facts in terms of more basic facts, and that it *unifies* many complex facts by relating them to a few of these more basic facts, helps account for the explanatory asymmetry in at least two ways. Firstly, as with causation there is a connection with knowledge. Since we tend to know more about the past than the future, the past to us is more "real" and "solid" - in the present context the past is more *basic* - than the unknown and mysterious future. If I am asked to explain why I think it will be a hot summer, I would naturally explain this possible future fact by appeal to what I know about the past. I might say that the birds migrated back early, or that the berries were already ripening. What I know about the past is much more accessible and solid and therefore I use it to explain a putative, uncertain future fact.

The second way derives from the fork asymmetry. According to this, two (or more) correlated events will usually be associated with a *single* earlier event. This means that explaining the later events in terms of the single earlier event *is a much better causal explanation than doing things the other way around.* By explaining in the earlier-to-later direction, two (or more) events are given an explanation in terms of just one single event. In other words, a "simple" single event explains the "complexity" of a diversity of events. As Horwich puts it:

> ... there is a gain in the simplicity of our characterization of the world as we move back in time from states of correlation to their unified determinants ... the earlier, central event in a fork allows a unified derivation of the separated correlated events and is therefore explanatorily more basic than them. (Horwich [1], p. 156)

This is the rough idea, but it is possible to say a great deal more. I will explore this last point in detail using material from an extensive discussion of this topic by David Owens in his book "Causes and Coincidences".

(xiv) Owens on Causal Explanation

The first to note about Owen's is that he identifies causation with causal explanation. Thus, for Owens, an account of the asymmetry in causal explanation is automatically an account of the causal asymmetry. I will discuss some implications of this identification later.

Central to Owen's account of the direction of causal explanation is the notion of *coincidence*. Suppose (to use one of Owen's examples) that I am getting married tomorrow. I'm quite religious and don't want it to rain on my wedding day, so I pray to God that there will be good weather tomorrow. And as it turns out there *is* good weather the next day.

At least two interpretations can be put on this story. If someone doesn't believe in God (or in the power of prayer) they will think that it is a coincidence that my prayer for good weather was actually followed by good weather. On the other hand, someone who thinks that this sort of prayer can work will feel that there was no coincidence involved.

The difference between the two interpretations seems to be that in the first case the weather is thought to come about through causal processes *independent* of my praying. But in the second case, the causal processes are not independent - my prayer is part of the causal process leading to the good weather. On the first interpretation, it may be no coincidence that I pray (given my religious beliefs) and it may be no coincidence that there is good weather (given the prevailing meteorological facts and the laws governing them), *but it is a coincidence that my prayer happens to be followed by good weather.* This is because there is no connection between the causal processes related to my prayer and the causal processes related to the good weather. On the second interpretation it is not a coincidence that the prayer is followed by good weather, since there is a causal connection between the two. A provisional definition of coincidence is therefore as follows:

> a coincidence is an event which can be divided into components separately produced by independent causal processes (Owens [1], p.13)

This is only a provisional definition though, because Owens wants to define causation in terms of coincidences. So he must define coincidence without the reference to causal processes. He does this by replacing the causal talk with talk about necessity and sufficiency. A coincidence, then, is:

> an event...[that] can be naturally divided into parts which are such that the (temporally prior) conditions necessary and sufficient for the occurrence of one part are independent of those necessary and sufficient for the occurrence of the other...(Owens [1], p.24)

Owens points out that this way of defining coincidence means that his usage of the word differs from everyday usage. In the everyday sense "coincidence" is usually reserved for striking or unusual events. Going on holiday to Timbuctoo and bumping into an old school friend, or falling off a bridge but landing on a soft-topped lorry, are coincidences in the usual sense of the word. But in Owen's sense the word has wider application. It is a coincidence that I am eating a packet of crisps and an asteroid is crashing into Jupiter. It is a coincidence that my shoes are black and Vladimir Horowitz was a pianist.

Owens now defines what he means by a *cause* as follows: *a cause is an event which ensures that its effects are no coincidence.* In other words, a cause is an event which explains why the joint occurrence of its effects is not coincidental. When a match is struck, it is no coincidence that there is heat, light and smoke all together. The necessary and sufficient conditions responsible for the heat, light and smoke are not independent but are in each case connected with the striking of the match. So the striking of the match causally explains the heat, light and smoke. And since causation is identified with causal explanation, the striking of the match is the *cause* of the heat, light and smoke.

Granted all this, how does Owens' account for the causal asymmetry? The key is the fork asymmetry[52]. This asymmetry means that the world contains branching structures of events. Following on from a single event will often be two or more correlated events. See figure 9.5. Suppose we want to give a causal explanation of the events shown in the figure. Going from earlier to later we can say that, given A, the joint occurrence of B and C is not coincidence. That is, the compound event of B and C occurring together cannot be split up into parts with independent necessary and sufficient conditions. But going from later to earlier a mass of coincidences is created. We try to explain A in terms of the joint occurrence of B and C, but this joint

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[52] Owens actually uses a slightly different asymmetry called the asymmetry of *overdetermination*. However, since this asymmetry seems to me only a variant of the fork asymmetry I have rephrased his discussion in terms of forks.

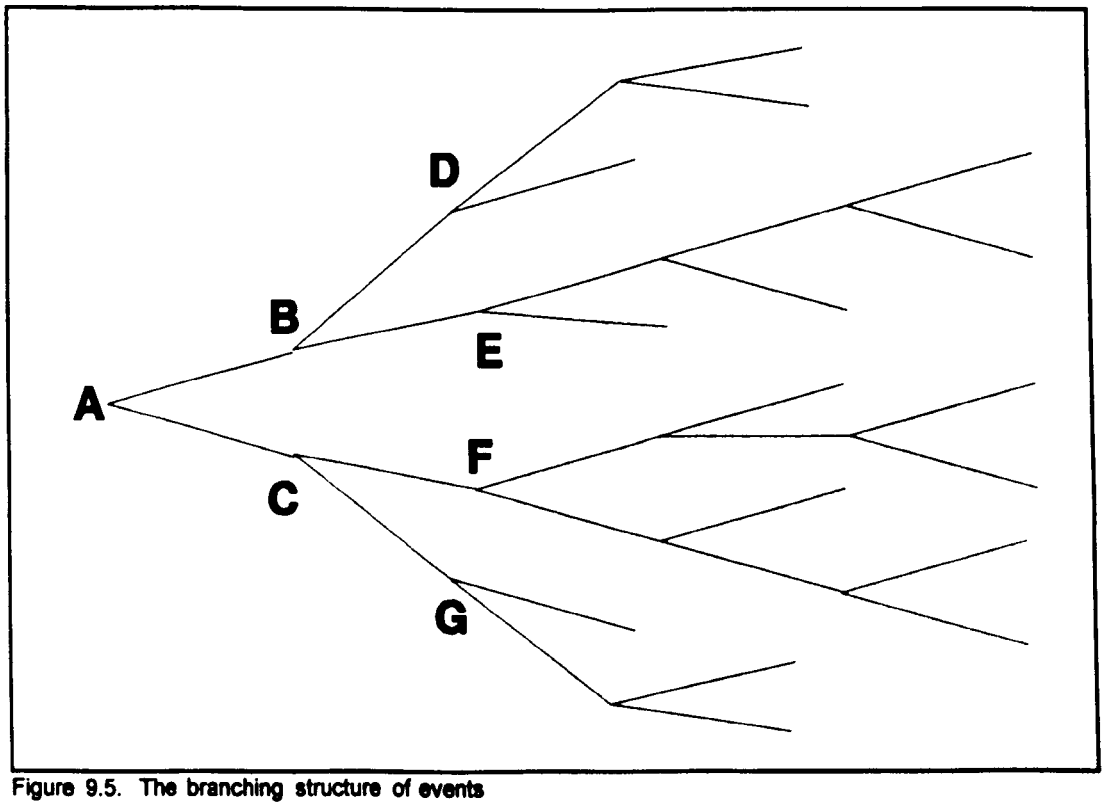

Figure 9.5. The branching structure of events

occurrence is a coincidence. This is because the conditions necessary and sufficient for B (D and E) are independent of those necessary and sufficient for C (F and G). Since the point of a cause is to prevent coincidences, we can conclude that A is the cause of B and C; and in general the direction of causation runs in the "splitting" direction of events (i.e. in the earlier-to-later direction).

(xv) Dummett's Apple Tree

Owens uses an example from Michael Dummett to give this idea more content. Dummett imagines a case in which the familiar process of an apple tree growing happens in reverse:

> The sapling grows gradually smaller, finally reducing itself to an apple pip; then an apple is gradually constituted around the pip from the ingredients found in the soil; at a certain moment the apple rolls along the ground, gradually gaining momentum, bounces a few times, and then suddenly takes off vertically and attaches itself with a snap to the bough of an apple tree. Viewed from the standpoint of gross observation, this process contains many totally unpredictable elements...(Dummett, quoted in Owens [1], p.99)

Consider what happens when the apple jumps up and attaches itself to the tree. There are apparently two independent processes going on here. There are conditions that lead the apple to roll and jump to that particular spot. And there are the conditions that are responsible for the tree being in the position it is; and what is more, to have the top of an apple stalk, half broken off, growing from a handy branch. Since these sets of conditions are quite independent of each other, the fact that the apple leaps to the half broken stalk on the tree is a complete coincidence. We cannot explain why it happens. Perhaps even more strikingly, other apples will be jumping up to branches of the same tree. The different processes leading each apple onto the tree are independent. The fact that they all end up on the same tree (rather than the neighbouring pear tree) is a coincidence.

(xvi) Causation and Causal Explanation

I think that Owens' work gives a good account of why causal explanation is asymmetrical with respect to time. The question now is: how does this asymmetry account for the causal asymmetry?

As I mentioned, according to Owens the question is automatically answered since *causation is nothing over and above causal explanation.* What does this mean? Earlier in the chapter I talked about causation as a relation between events - event X causes event Y; the throwing of the brick causes the breaking of the window. If we treat causation like this we would say that *event e causes event f.* But on Owen's account there is no such causal relation between events. Rather causal talk should be of the form *statement p is true because statement q is true.* In other words, statement p *causally explains* statement q. As Owens puts it:

> the way seems clear for us to treat all singular causal statements as of the general form 'p because q'. Nor is any advantage to be gained from bifurcating these statements into causal explanations of the form 'p because q' and causal statements of the form 'c causes e' (Owens [1], p.62)

The obvious objection is that surely causation cannot merely be a way in which we explain things. Explanation is something done by people (or at least some kind of sentient being). If there had been no people in the universe, there would have been no causation. And even granted that there are people, causation is not "in the object themselves" as we would ordinarily

think. If there is no objective causal relation between events, what are we to make of the correlations we find between events? Heat, smoke and light are all correlated with striking a match, but surely this implies that the striking of the match is causally responsible for these effects, or has some objective causal relation with them?

Owen's answer is that there are indeed *functional or nomological relations* between events. He gives the example of Snell's law, which

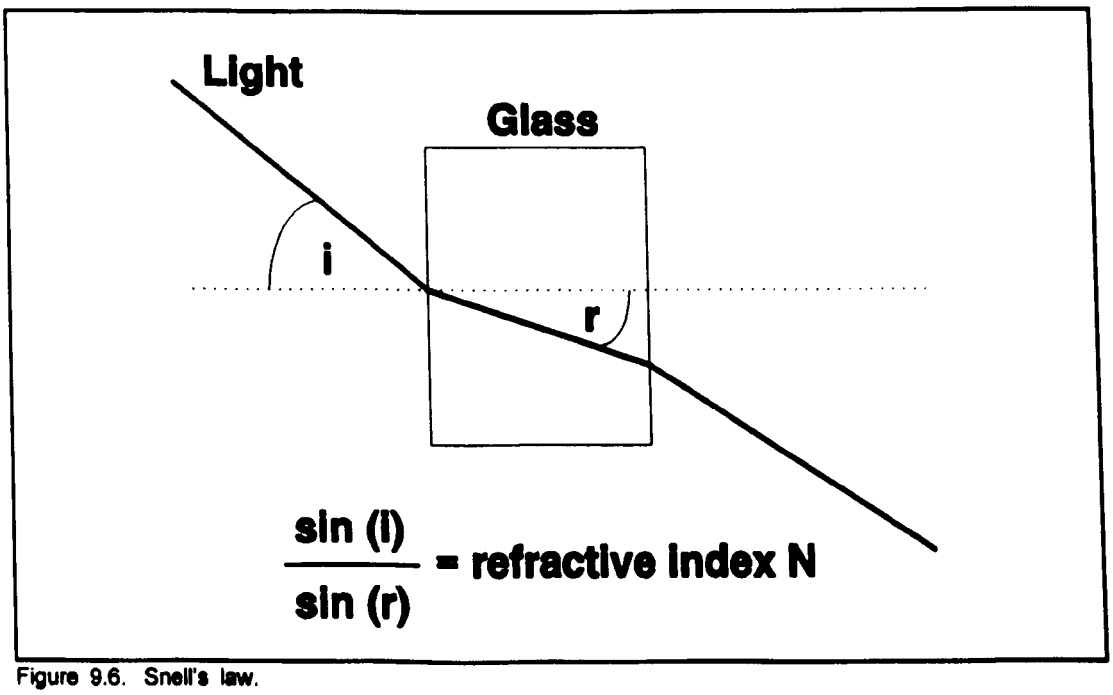

Figure 9.6. Snell's law.

governs how a ray of light is refracted when it passes from air into glass. See figure 9.6. The angle of incidence and the angle of refraction are related by a formula N = sin(i)/sin(r) i.e. the refractive index of the glass N is equal to the sine of the angle at which the light falls on the glass (the angle of incidence) divided by the sine of the angle at which the light is refracted (the angle of refraction). Given that we know the refractive index of the glass and one of the angles, we can calculate the other angle. But this law, although describing something about how the world works, needs to make no reference to events causing one another. There is a *functional* relation between the two angles (given one, there is a lawlike function enabling us to work out the other), but not a causal relation.

This has been a common view in some circles for many years. As Mackie writes:

> ... already in 1912 Bertrand Russell was arguing that the concepts of causation and of causal law ... were from the point of view of science out of date, perhaps even incoherent, and had been or should be replaced by the notions of functional relation... (Mackie [1], p.143)

So, according to Owens, there are objective functional or nomological relations between events. But regarding one of these events as the cause and the other as the effect has no basis in the physical world - causal talk is only a product of our need to *explain* things.

This seems to me to be a defensible view. This is just as well, since *it is likely that this kind of view is an inevitable consequence of the knowledge approach to the asymmetries.* According to the knowledge approach, the asymmetry of causation derives from a number of other asymmetries: forks, knowledge, decision, action, and explanation. This high-level derivative status of the causal asymmetry does not sit easily with the view that causation is a fundamental asymmetric relation between events[53].

The advantage of this view in the present context is of course that we now have an account of the causal asymmetry. This account is predominantly rooted in the asymmetry that forks introduce into causal *explanation.* But as we saw the knowledge asymmetry and action asymmetry also probably have a role to play.

This completes the discussion of the higher level members of the knowledge explanatory map. So far I think a good case has been made. But, as with the causal approach, the most difficult problems occur when we try to account for the central asymmetry (in this case knowledge) and the lower level asymmetries.

(xvii) The Knowledge Asymmetry and Recording Systems

The first step Horwich takes when explaining the knowledge asymmetry is to outline what features a standard *recording system* should have. It is these recording systems that are responsible for the traces that play such an important role in the knowledge we gain.

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[53] One might say that while the asymmetry of causation is something quite derivative, causation itself - that is, a symmetrical causal relation - is still a fundamental and real feature of the world. But there is little difference between this view and Owens'. The question is only whether we should call the real symmetrical relations between events *nomological* or *causal*. This is surely only a matter of terminology.

The first feature of a recording system is that the system should be able to enter a range of different states S(1), S(2), ... , S(n). And these states should be *stable*, so that when the recording system enters one of these states it will usually remain there for a reasonable length of time. The system should be designed so that these states will each be correlated with particular external circumstances. If there is a range of circumstances C(1), C(2), ... , C(n), the system should be designed so that C(1) ensures that the system enters state S(1), C(2) ensures that the system enters state S(2), ... , and C(n) ensures that the system enters state S(n). More precisely, *each C(i) should be necessary and sufficient for each S(i).*

As an example, a simple device could be made to record whether or not it rained on a particular day. The device should be made so that if and only if there is rain during a given period a red light will come on; and if and only if there is no rain during that period a green light will come on. As long as the lights remain on undisturbed (i.e. these states are reasonably stable) anyone looking at the device at a later time could then tell whether it had rained or not.

(xviii) Forks and Knowledge

Does this account of a standard recording system offer a clue to how to explain the knowledge asymmetry? The difficulty is that no reference can be made to causation, since causation is held to be at a much higher level in the knowledge explanatory map. If causation could be used the explanation is simple: recording systems only record past events, since only past events can *cause* the system to enter into different states. Future events can clearly have no causal influence on the recording system.

Instead of causation, Horwich attempts to use the fork asymmetry. Firstly, he argues that for any given recording system there will be a large amount of "non-informative" possible states it could be in (i.e. states which are not associated with any particular external circumstances). A good example is a camera. There are many, many possible ways in which light will fall on the film. Most of these ways will mean little to us - they will be only random patches of light and dark. A few of the possible ways may mean something - the light may fall in such a way as to produce an image of me on holiday wearing a daft straw hat, or of a German couple I met on the beach.

The curious thing is that on the whole the system will tend to cluster around a relatively small group of informative states. The pictures that are eventually developed from my camera will almost all mean something, even if this is only that I had my thumb over the lens. Horwich writes:

> the rough idea [is] that if a system has numerous macroscopically similar states, of which some small number occur disproportionately often, then the tendency of the system to concentrate in those special states constitutes a correlation for which we should expect a causal explanation" (Horwich [1], p.88)

Horwich thinks these sort of correlations make recording systems an instance of the fork asymmetry. This idea is slightly hard to grasp, since the correlations involved do not seem to fall neatly into the basic fork structure of one earlier event being associated with two or more later events.

Perhaps the following example may help. Suppose several tape recorders are placed in a room in which a short piece of music is played. The tape recorders are started up and left to run until the music finishes. When the tapes are compared they are all found to be in the same state - call this state S(k). For the tapes to be in S(k) (given the number of other states they could be in) is quite unlikely. That is, given random background conditions it is highly improbable that the tapes would enter that S(k). This means that there is a correlation to be explained: why should all the tapes cluster in that one particular state out of all the millions of other states they could have entered? According to the fork asymmetry, given this sort of correlation there must be a common earlier event. The common element is that all the tapes were placed in a room where the external condition was C(k) (the music being played). Since we know that events always occur in the "normal fork" pattern (correlated events share a common earlier event), the correlation of the tapes being in S(k) is strong evidence for C(k). For this reason we can justify our trust in various recording systems - or in other words, in traces.

The asymmetry in our knowledge is explained by the rarity of "inverse forks". Given the above understanding of recording systems, a system which could record the future would be an instance of an inverse fork. That is, a correlation amongst the recording systems would be associated with a single later event (the future event being recorded). But inverse forks are extremely rare and coincidental; so it follows that recording systems able to record the future will also be extremely rare - so rare as to be almost non-existent.

Again the tape recorder example may help with this. Suppose that a batch of fresh tapes were placed into the recorders. To our surprise we find that *prior to any music being played* all the tapes in the room were found to have Beethoven's Fifth Symphony recorded on them. And it just so happens that this is the music that we were going to play. If we repeat this experiment many times with the same results, we will have discovered a correlation in an inverse fork pattern - two or more earlier events (the tapes being found to contain the Fifth symphony) associated with a single later event (the symphony being played). If we could be sure of this correlation happening in general circumstances then we can use these tape recorders to gain knowledge about what music is going to be played. In other words, the inverse fork pattern of events would give us knowledge of the future.

This seems fair enough, but a problem is that the above examples are artificial. We do not as a rule need two or more tape recorders simultaneously recording a symphony to gain knowledge that a symphony has been played. One tape with the symphony on is enough. *But in this normal situation there appears to be no fork pattern.* This problem applies much more generally. Many, many cases of knowledge do not appear to fall easily into a fork pattern. When I hear the doorbell ring I do not need to record this on several tape recorders as well as hearing it with my own ears in order to deduce that someone is at the door. Simply hearing the bell ring myself is sufficient. When reading reference book or history book, I do not need to double-check everything I read with other books in order to deduce that the events recorded in the original book really happened. Usually I can trust the single book I am reading. Since most of our everyday trace-knowledge does not appear to fall into a fork pattern, how can Horwich think that the fork asymmetry explains why we have more knowledge of the past than the future?

One possible solution is to distinguish between particular cases of knowledge and *the means by which we originally come to accept particular ways of gaining information as reliable.* Why, for instance, do we rely on our own memories? Part of the answer may well be to do with forks. In many cases, my own memory of a given event (the Berlin wall coming down) will be corroborated by many other traces. Other people will remember it; there will be books and photographs about it; there will be bits and pieces of rubble where the wall used to be. In other words these traces fall into a fork pattern similar to my example in which several tape recorders were placed in the same room and all recorded Beethoven's Fifth Symphony. The "tip" event will

be the Berlin wall coming down. There will be multiple "prongs" including amongst other things my own memory, a photograph in a book, a piece of rubble, and so on.

The fork asymmetry tells us that since these multiple "prongs" are correlated, we should expect there to be a common earlier "tip". In other words, the plethora of traces caused by the Berlin wall coming down is strong evidence that the original event really occurred.

The point is that this kind of situation is quite common. My own personal memory is often corroborated by a wide variety of other sources. When corroborated in this way my memory is only one of many "prongs" of a fork, and I can therefore infer that the earlier event really did take place, *and that therefore in these cases my memory has proven to be reliable.*

Given the frequency with which this occurs, the fork asymmetry will allow me to gradually build up faith in my own memory. I will feel in general that my memory is a reliable source of information. And having once built this faith up, I will be justified in trusting my memory *even in the absence of any obvious fork pattern.* Thus I remember hearing Beethoven's Fifth Symphony. There may be no obvious forks (no cluster of tape recorders, or other listeners) but my memory will still be able to give me knowledge.

I do not deny that there may be problems with this account, but it seems to me that this is a plausible attempt to explain the knowledge asymmetry solely in terms of forks.

(xix) Entropy, Forks and Initial Conditions

Moving on, what more can be said about the lowest levels of the knowledge explanatory map? A good place to start is with Horwich's discussion of entropy. As I mentioned in Chapter Eight that the puzzling question about entropy is not so much "why does entropy increase?" as "why was entropy low in the past?" At the end of my account of entropy in Chapter Eight I pointed out that the most plausible way of answering this second question is to call upon certain *boundary conditions* that obtain in the early stages of the universe. These conditions override the usual statistical considerations and ensure that the early universe is in a state of low entropy.

What could the relevant boundary conditions be? Horwich suggests an idea put forward by various physicists about the Big Bang:

> The idea, very crudely, is that in the beginning the expansion of the universe was faster than the rate of equilibration, thus creating pockets of low entropy. In other words, the tendency of energy to even itself out was overwhelmed by the violence of the explosion, and so local concentrations of energy were formed (Horwich [1], p.71)

The plausibility of this account and the exact nature of the relevant boundary conditions are a matter of physics. I mention the above idea in order to give an example of the sort of conditions that might explain puzzles to do with entropy. Beyond pointing out the need for these conditions, I will not go further into the problem of what the conditions might be.

Although the main puzzle about entropy is why it was low in the past, Horwich notes that the statistical explanation of entropy increase itself makes an important assumption. Roughly, the assumption is that systems evolve randomly. In terms of Boltzmann's analysis, it was assumed that all the possible arrangements of atoms that a system could enter into were equiprobable. The system has no bias towards any particular arrangement. This assumption is crucial because only on this basis can it be argued that equilibrium is the most probable state.

To make this point clearer, a dice can land on any one of six sides. It seems to follow that the probability of throwing a number greater than 4 is 1/3, that the probability of throwing a number less than 4 is 1/2, and that the probability of throwing a 4 is 1/6. The most probable outcome is therefore throwing a number less than 4. But the assumption underlying this is that it is equally likely for the dice to fall on any of its six sides. The probability of throwing any given number is exactly 1/6. What if the dice is weighted? In this case the probability of throwing a six might be 1/2; and the probability of throwing any other given number 1/10. These odds would ruin the above calculation.

So is there a reason to think that systems evolve randomly (entering any possible state with equal likelihood)? Or might systems be biased to a degree that entropy decreases turned out to be much less unlikely? If the answer to the second question is "yes", then the foundation of Boltzmann's statistical mechanics is undermined.

Horwich suggests that there is a boundary condition - one of the initial conditions holding in the very early stages of the universe - which he calls *initial micro chaos*. His idea is that in the initial stages of the universe there is a great deal of randomness at the microscopic level - there are no

correlations between what different particles do. Initial micro chaos is thus closely related to the principle of innocence. At the microscopic level particles are innocent of each other and hence in a state of complete "chaos".

This microscopic randomness, Horwich suggests, ensures that entropic systems evolve at random (the entropic dice are not weighted). He also suggests that this boundary condition might underlie the fork asymmetry. To understand his idea it will be useful to look more closely at the relationships between the events that make up a given fork.

(xx) More About Forks

Take a standard example of a normal fork - the striking of a match (event C) is associated with heat (event E) and light (event F). The striking of the match is necessary for the heat and light. Assuming that the matches are not damp etc. the striking will also be a sufficient condition for the heat and light[54].

But since the striking of the match is necessary for the heat (E), then the heat is *sufficient* for the striking of the match. Given that there is heat, the match must have been struck. The heat is also *necessary* for the striking of the match - if there was no heat, then it couldn't have been the case that the match was struck. It follows also that the heat is necessary and sufficient for the light. This is because given that there is heat the match must have been struck, and given that the match was struck there must be light; and if there is no heat the match wasn't struck and therefore there is no light. *Each event on a normal fork, then, is necessary and sufficient for the other two events.*

Now look at some scenarios in which there is an inverse fork. Suppose first that poor John Brown is walking harmlessly along a road when he is simultaneously shot and stabbed, resulting in his death. Now suppose that both the shooting and stabbing were each sufficient to kill John. It follows that neither are necessary. Since the shooting is sufficient but not necessary for John's death, John's death is necessary but not sufficient for there having

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[54] When forks are usually discussed, probability notation is used. Rather than the lighting of the match being sufficient for the heat and smoke, it is said that the striking raises the probability of there being heat and smoke. More formally the probability of there being heat (A) given that a match has been struck (C) is very much greater than the probability of there being heat in other conditions i.e. $P(A|C) >> P(A)$. The claim that the striking of the match is sufficient for there to be heat is equivalent to saying $P(A|C) = 1$, and the claim that the striking of the match is necessary for there to be heat is equivalent to saying $P(C|A) = 1$. That is, necessity and sufficiency are extreme cases in which probability becomes certainty. For simplicity I will use the terms "necessary" and "sufficient" and avoid the needless complexities of probability notation.

been a shooting. Likewise for the stabbing. The shooting and stabbing therefore are unconnected - neither necessary nor sufficient for each other.

Secondly, suppose that John is again stabbed and shot. But in this case neither the stabbing nor the shooting is alone sufficient to kill him. What kills him is the combination of the two. It follows that both are necessary for his death, but neither sufficient. So John's death is sufficient for both, but necessary for neither. Again the stabbing and shooting are independent - neither necessary nor sufficient for each other.

There is therefore a strikingly different pattern of necessary and sufficient conditions on normal forks and the inverse forks so far considered. On normal forks each event is necessary and sufficient for each other. On inverse forks there are some relations between the "tip" and the two "ends", but no relation between the two ends. Thus it is sometimes said that the tip *screens off* the two end events from one another.

It can be seen why inverse forks like this rarely occur. It would be an unlikely coincidence for two events to happen at just the right moment and in just the right way to lead to a joint "effect". This is simply unlikely to happen very often. We can suppose that two people quite independently decided to kill John - in this case it is a pure coincidence that both tried at the very same time. This would probably be clearer in a non-human case, since it is easy to imagine some prior collusion between the people involved. Suppose then that a tree fell on John's head just as an out of control car smashed into his side. Since the tree and car are not connected to each other, it is a huge unlucky coincidence that both happened at the same time.

But do we ever get inverse forks in which every event is necessary and sufficient for every other? The answer is both yes and no. Recall an example I gave in Chapter Eight. Suppose two people coordinate their efforts to lift a sofa: their individual efforts form the "prongs" of the fork, and the lifting of the sofa forms the tip. As I pointed out, this sort of inverse fork is invariably connected with an earlier normal fork. For example, the "tip" of this normal fork might be someone shouting "lift!" and the two "prongs" might be each person hearing this word.

Suppose that, for each person, hearing the word "lift!" is a necessary and sufficient condition for them straining their muscles. Now follow the connections *backwards* in time from the event of one person (person A) straining his muscles. Since hearing the word "lift!" is necessary and sufficient for person A straining his muscles, person A straining his muscles is also necessary and sufficient for hearing the word "lift!". Person A hearing

the word "lift!" is in turn necessary and sufficient for someone uttering the word "lift!". Someone uttering the word "lift!" is necessary and sufficient for person B hearing the word "lift!" and this in turn is necessary and sufficient for person B straining his muscles. It follows that person A straining their muscles is necessary and sufficient for person B straining their muscles.

Thus although both A and B need to exert themselves to lift the sofa, person A straining his muscles is necessary and sufficient for lifting the sofa. This is because person A straining his muscles implies that person B does as well. So this inverse fork structure exactly parallels a normal fork in that every event on it is necessary and sufficient for every other.

So we do get some inverse forks like this. But the important point to notice is that these inverse forks will always be associated with an earlier normal fork. And clearly a great proportion of normal forks *are not in fact followed* by an inverse fork. There are perhaps two main reasons for this. Firstly, most examples of these sort of inverse forks are related to intelligent life (the two people lifting the sofa). Normal forks occur in all situations whether intelligent creatures are involved or not.

This first point is just a special case of the second point. This second point is that inverse forks are only likely to follow on from normal forks *if there is a great deal of correlation about.* If someone just shouted "lift!" the two people would be unlikely to lift the sofa. It is only because of a prior agreement (even if only implicit) that the two people respond appropriately (e.g. the three people involved might have formulated a plan: "you two grab the sofa, and I'll count you in"). This is a very simple example, but the point I am trying to make is that an inverse fork is only likely to follow on from a normal fork if there has already been a great deal of interaction between the different "systems" involved. From the point of view of the universe, this degree of interaction and correlation is relatively rare.

So although we do get some examples of inverse forks following on from normal forks, normal forks will still be much more numerous. The real reason for this is simply that an inverse fork in which each event is necessary and sufficient for every other is highly unlikely to arise independently (i.e. without an earlier normal fork).

Suppose for example, that John is both stabbed and shot. Suppose also that *neither the stabbing nor the shooting can occur alone*, without this being due to an earlier normal fork. To ask why are there no inverse forks of this kind is to come to the heart of an explanation of the fork asymmetry. The reason appears to be connected with the idea of *innocence* I mentioned in

Chapter Eight. This is roughly the idea that before objects, particles, systems or whatever interact there is no association or correlation between them. Which states that the systems happen to be in before interacting with each other are entirely independent. This principle is closely allied to Horwich's boundary condition of initial micro chaos.

How does the principle of innocence or initial micro chaos explain the rarity of this last type of inverse fork? The reason is simply that inverse forks of this third type are in direct conflict with the principle of innocence. For example, innocence means that prior to an interaction, the two processes leading to the shooting and the stabbing are independent of each other. So there can be no chain of necessary or sufficient conditions connecting them.

It follows that the only types of inverse forks compatible with innocence are either coincidental and unlikely ones (where the events are not each necessary and sufficient for each other) or ones which follow on from earlier normal forks. Now it is clear that the unlikely sort of inverse forks will not happen very often.

It follows, then, that normal forks will be far more common than inverse forks. And the key reason for this is this idea of *innocence* or *initial micro chaos.*

These ideas are obviously highly speculative. This is inevitable given the deep nature of the topic, and our imperfect knowledge of the origin of the universe. But I think the general point is more robust than the particular details: whatever the precise explanation, it is likely that the fork asymmetry and entropy rest upon conditions to be found in the early stages of the universe.

With this section the last pieces of the knowledge explanatory map have been filled in. I will now turn to the third and last approach I will consider.

PART 3 - THE SYMMETRY APPROACH

(xxi) The Symmetry Approach

The last approach to the asymmetries I will look at I call the *symmetry* approach. The emphasis here is that things may not be so asymmetrical as they appear. The material for this part of the chapter is derived from Huw Price's book "Time's Arrow and Archimedes' Point"

It is possible to construct an explanatory map to give an overview of Price's ideas, but at first sight it may seem a little complicated. See figure 9.8. I will make only a few introductory comments here - other details will be filled in during the course of the discussion.

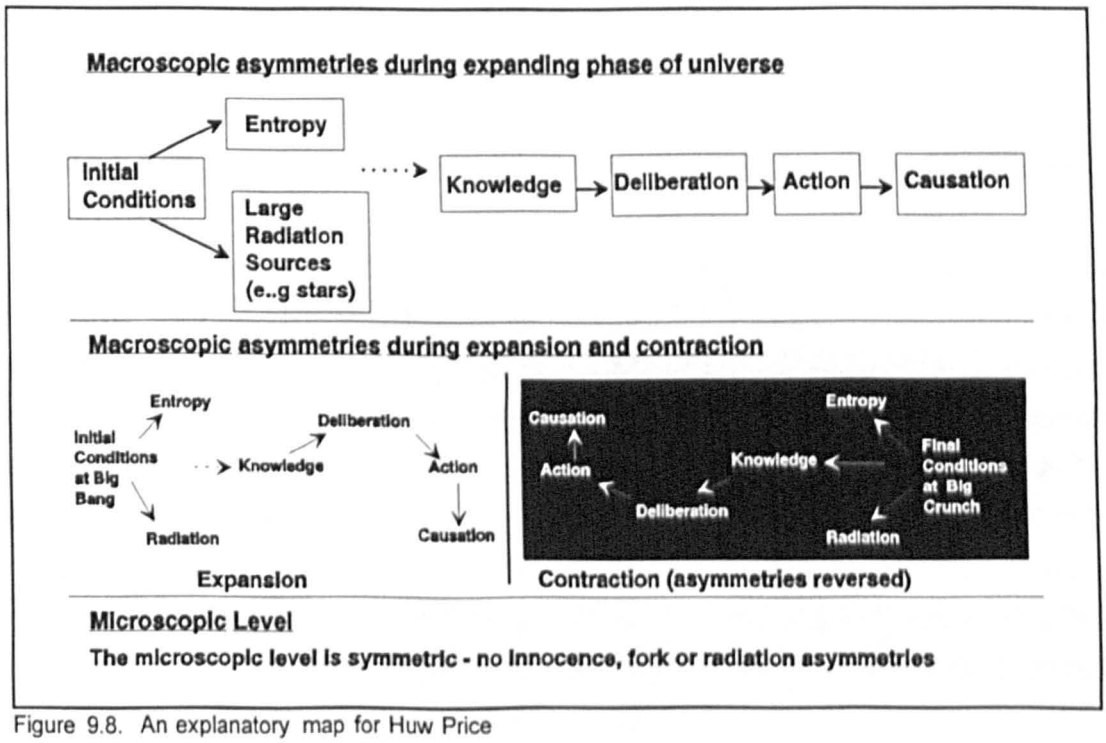

Figure 9.8. An explanatory map for Huw Price

The map divides into three main parts. The first part concerns the asymmetries at the macroscopic level during the expanding phase of the universe. The dotted arrow in the middle of the first map indicates that while Price considers that there is a link between the group of low level asymmetries (entropy etc) and the higher level asymmetries (action, decision, etc), he does not make the nature of this link explicit.

The second part concerns asymmetries over the whole history of the universe from Big Bang to an ending in a putative Big Crunch. What will happen to the asymmetries if the universe began to contract towards a Big Crunch is an open question. One suggestion that appeals particularly to Price is that the final conditions obtaining at the Big Crunch mirror the initial conditions obtaining at the Big Bang. Since these conditions form the basis of the other higher-level asymmetries, this would have the effect of *reversing the time-bias*. Entropy would decrease; intelligent creatures would know more about later times than earlier times; and causation for them would run from later to earlier.

The third part concerns the microscopic level. Price holds that the microscopic level is basically symmetrical, so in this case there are no asymmetries to be related.

In what follows I will not offer much discussion of the first part of the above map. Overall Price's view of the asymmetries is closer to the knowledge approach than the causal approach. My interest here is in the second part (in which the familiar asymmetries are *reversed* as the universe contracts) and the third part (in which the microscopic world is held to be symmetrical).

In one sense it is misleading to present the symmetry approach as an alternative way of looking at the asymmetries, since the aspects I will be concentrating on are not about how to explain the asymmetries and how they are related to each other. The symmetry approach to some extent *bypasses* the important issues in other approaches. It argues that regardless of how the macroscopic asymmetries are explained there is an important respect in which the universe is symmetric (i.e. on the microscopic level). And it argues that given any account of the asymmetries in which initial conditions play a fundamental role, these macroscopic asymmetries are not absolute, but might be reversed in the contracting phases of the universe.

(xxii) The View From Nowhen

Before looking at Price's ideas, it is important to introduce what he calls the *Archimedean view* or the *view from nowhen* - it is this view which underlies his whole approach. The rough idea is that, in thinking about the direction of time and temporal asymmetries, we should in effect *place ourselves outside time*. As Price writes:

> One of my main themes is that physicists and philosophers tend to think about time from too close up. We ourselves are creatures in time, and this is reflected in many ordinary ways of thinking and talking about the world. This makes it very difficult to think about time in an objective way, because it is always difficult to tell if what we think we see is just a product of our vantage point. (Price [1], from the preface)

Because we live in time, and time is such a central feature in our lives. It is hard to "step back" and see time in a more objective light. As Price points out, one role of physics and philosophy has been to disentangle what

features belong to the world "in itself" and what are "contributed" by us. The classic distinction is between primary and secondary qualities. In terms of this distinction the world "in itself" was regarded as having shape, size, quantity, mass, etc; but the appearance of colour, sound, tastes, smells, sensations, do not belong to objects as they really are but are a product of our interaction with them. Price's point is that this same sort of disentangling needs to be applied to time. In thinking about time we need to try to adopt an atemporal perspective, freeing ourselves from misleading notions about time based on the way we experience it.

(xxiii) Microscopic Symmetry

I will begin by briefly touching on Price's views about asymmetry on the microscopic level of atoms and elementary particles. Price's ideas are quite radical and complex: there is no room to do them full justice here. I will therefore just outline some of the main points about microscopic symmetry, then discuss in more detail the possibility of the macroscopic asymmetries being *reversed* in the later half of the universe.

The discussion of Horwich showed that innocence and forks are among the root asymmetries. Price distinguishes between two levels on which innocence and forks are taken to operate: the macroscopic level of trees, people, planets and stars; and the microscopic level of atoms and elementary particles.

Roughly, Price holds that innocence on the macroscopic level is a result of (a) the large number of particles involved and (b) initial boundary conditions. But innocence on a microscopic level is a different matter.

Price calls innocence on a microscopic level *μinnocence*. Intuitively μinnocence is a genuine asymmetry. When we imagine two microscopic particles that have never interacted before colliding we tend to think of their velocities and energy levels etc. as being uncorrelated. Other than this intuition, however, it is not clear what else could support this idea. On the other hand Price suggests there are some good reasons for rejecting the principle of μinnocence.

The first reason is that, as a physical principle governing the behaviour of particles, μinnocence is in a complete conflict with the otherwise nearly perfect symmetry of physical law. Time-reversal invariance is an established principle in physics - rejecting μinnocence would remove a source of conflict.

The second reason is to be found in quantum theory. As I outlined in Chapter Two the idea of later states affecting earlier states was one solution to some quantum theory problems. This amounts to a rejection of μinnocence. There is no room here to go into detail but Price argues at some length that getting rid of μinnocence has very beneficial consequences in the realm of quantum theory. He goes as far as to say that it is the combination of quantum theory with the principle of μinnocence that leads to difficulties like non-locality, incompleteness, etc.

Thirdly, Price argues at length that there is no radiation asymmetry at the microscopic level, by presenting a refined version of the Wheeler-Feynman absorber theory (see appendix A for an account of this theory). The symmetry of radiaton is closely connected to forks. Indeed, waves expanding around a light source appear to be a special type of fork: the "tip" is the source, and the many "prongs" are the outgoing waves. But for Price this asymmetry simply doesn't exist. It follows, he argues, that at the microscopic level there is no fork asymmetry.

For a detailed defence of these ideas see Price [1]. In this context I only want to stress the profound implications the failure of the two asymmetries of innocence and forks have on the microscopic level. These are very fundamental asymmetries, and many higher level asymmetries are dependent upon them. In particular, the causal asymmetry rests upon forks. It follows that if there is no fork asymmetry at the microscopic level, *then there is no microscopic asymmetric causal relation.* Fascinating and provocative as these ideas are, I will now have to leave them and turn to the possible reversal of the macroscopic asymmetry.

(xxiv) A Cosmological Asymmetry

In Chapter Four of his book, Price draws attention to a very basic sort of asymmetry - an asymmetry between the conditions at the *beginning* of the universe, and the conditions at the *end.* The best way to see this asymmetry is to consider entropy.

Suppose that the universe started with the Big Bang, but will eventually contract in upon itself into a Big Crunch. See figure 9.9. What will happen to levels of entropy during the contracting phase of the universe? The orthodox view is apparently that entropy will go on increasing. The reason behind this view is that entropy decrease would be a highly unlikely thing to happen, in the light of Boltzmann's statistical analysis. Entropy decrease

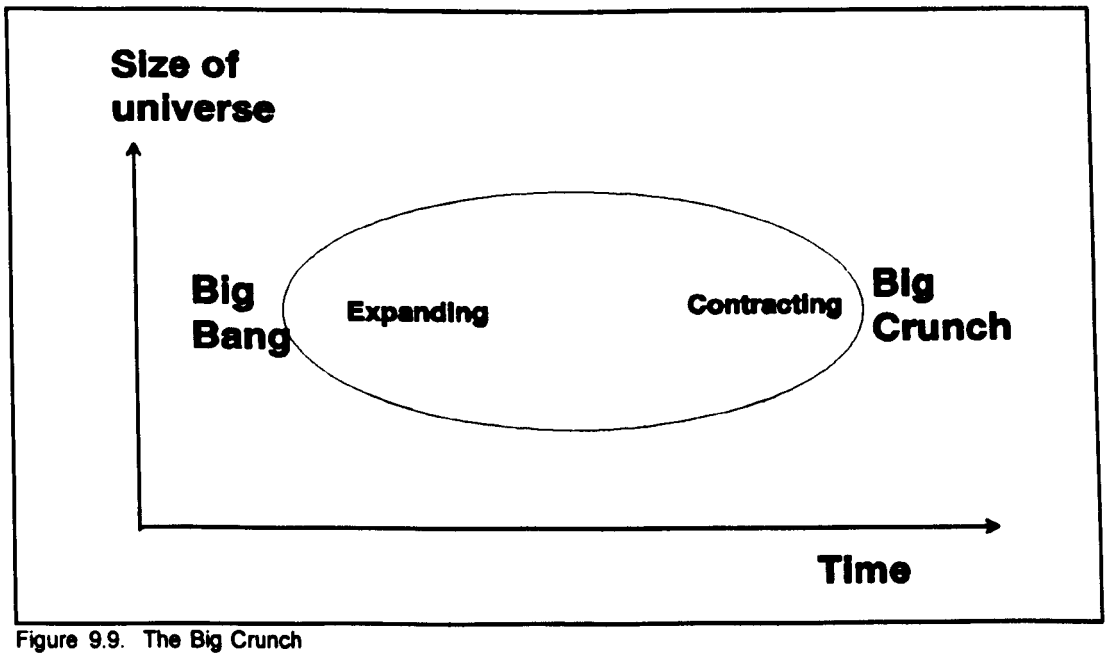

Figure 9.9. The Big Crunch

would involve oddities like water in a bath spontaneously boiling at one end but freezing at the other.

But Price offers the following thought experiment. Imagine the expanding phase of the universe, but *reverse* the supposed temporal direction. Since entropy increases in the expanding phase, this gives an image of a contracting universe in which entropy decreases as the universe shrinks. Now consider the actual universe but try to adopt an atemporal viewpoint. Looking at things this way there is no sense in which time in the universe "runs" in a particular direction. This means that the actual expanding phase of the universe *can equally well be seen as a contracting phase in which entropy decreases.*

From the atemporal view there is an odd asymmetry if entropy increases even in the contracting phase of the universe. See figure 9.10 (a). A universe in which entropy decreases in the contracting phase is no more unlikely than a universe in which entropy increases in the expanding phase, since the two scenarios are identical when seen from an atemporal perspective. Why shouldn't things be symmetrical as shown in figure 9.10 (b)?

The underlying asymmetry that makes figure 9.10 (a) the orthodox view is an asymmetry in boundary conditions. Boundary conditions are stipulated at the beginning of the universe to *override* the statistical unlikelihood of low entropy and thus ensure a low entropy past. *But no analogous boundary conditions are stipulated to hold at the end of the universe to ensure a low*

entropy future. If these boundary conditions were held to obtain, they would override the statistical unlikeliness of entropy decreasing.

It is true that the conditions that must have obtained at the beginning

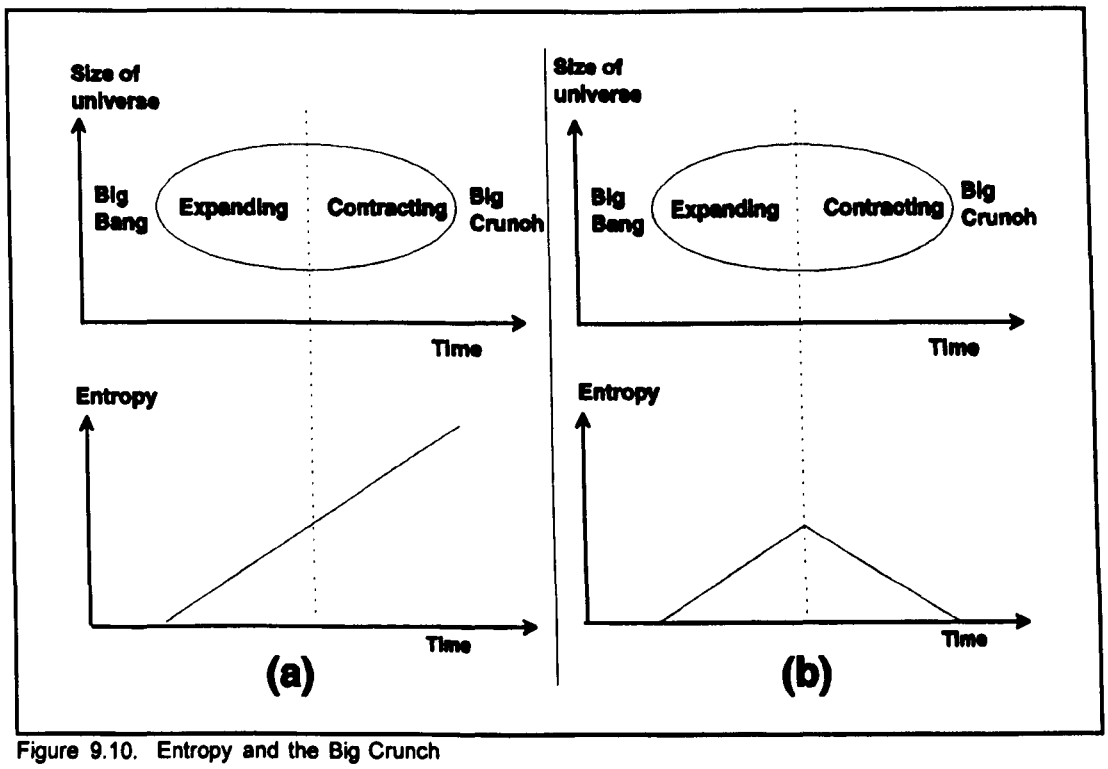

Figure 9.10. Entropy and the Big Crunch

of the universe have a very special nature. Slight differences either way would not have led to initial low entropy, or to the stars and galaxies responsible for the (macroscopic) radiation asymmetry. Price cites Penrose as estimating that *only 1 in $10^{10^{123}}$ universes would have the right sort of initial conditions*. So the real puzzle is why the initial conditions have such a special nature. But Price's point is: if we can find a reason why the initial conditions are so special, why shouldn't this reason ensure that the final conditions have this special nature as well?

(xxv) A Gold Universe

A universe of the sort, in which the final conditions match the initial conditions, is called a *Gold Universe*, after the cosmologist Thomas Gold. Is the universe we see around us consistent with the theory that it is really a Gold universe? Price argues that the answer is "yes".

If so, there are interesting implications. In a Gold universe there is no boundary condition asymmetry. This means that the contracting phase of the

universe will be a *mirror image* of the expanding phase, so far as the asymmetries I have been discussing are concerned. Entropy will decrease. Along with this, forks and innocence at the macroscopic level will be reversed. But these three - entropy, forks, innocence - are key asymmetries. *If they are reversed knowledge, decision, action, causation, explanation, and value will be reversed as well.* All these asymmetries, then, must be taken with a pinch of salt: they are not absolute but will vary during different phases of the universe.

This is a fascinating possibility. Unfortunately I do not have room to discuss it fully here. I will discuss just one possible problem with such a universe. For full details see Price [1], Chapter Four.

The problem I will mention here is to do with what happens when the universe begins to contract and therefore overall entropy starts to decrease and inverse forks become more common. Suppose that there are still humans at this future time. Because of the connection between forks, entropy and all the higher level asymmetries, it has been held that as soon as the universe begins contracting these people would suddenly find themselves "remembering" the future, acting to affect the past, and so on!

This seems a bizarre possibility. But in fact it rests on a confusion about what a Gold universe is. Price distinguishes between what he calls the

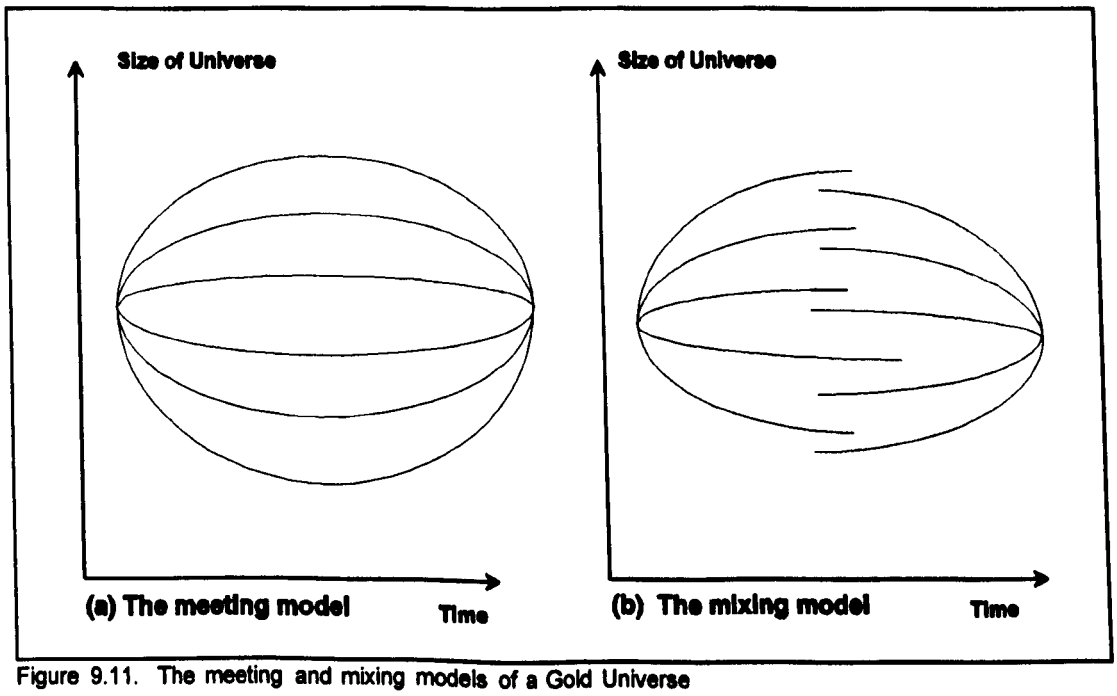

Figure 9.11. The meeting and mixing models of a Gold Universe

meeting model and the *mixing* model. See figure 9.11 (a) and (b). The meeting model is as described above: in the contracting phase any people left over from the expanding phase will suddenly find themselves remembering

the future, etc. A more plausible way to understand a Gold universe, however, is the *mixing* model. In this model people would retain their usual entropy orientation even when they enter the contracting phase of the universe. That is, they would carry this orientation with them since although they are now in the contracting phase *they are nevertheless products of the expanding phase.* As the universe contracts further, things will no doubt seem increasingly bizarre and "backwards" to them; but they themselves will retain their usual orientation.

Similar points will naturally apply to any beings who are products of the contracting phase. Their time-sense will be exactly the reverse of ours, *even when they enter into our expanding phase.* Thus the lines in figure 9.11 (b) "mix". Contracting phase beings carry over their "reversed" orientation into our expanding phase, and any expanding phase beings still alive will carry over their orientation into the contracting phase[55].

(xxvi) Alternatives to a Gold Universe

A Gold universe is one option. But might there be some reason for allowing an asymmetry in boundary conditions, so that the reversal of the above asymmetries could be avoided? Price considers three other possible suggestions: the *corkscrew model*, the *anthropic view*, and Penrose's *asymmetric law proposal.*

The rough idea behind the *corkscrew model* is that although physical laws may be symmetrical, each individual universe in which they operate will usually be asymmetric in one way or another. The reason for the name is the following analogy:

> Think of a factory which produces equal numbers of left-handed and right-handed corkscrews ... Each individual corkscrew is spatially asymmetric, but the production as a whole is completely unbiased ... Or think of an organisation whose employment practices show no bias at all between men and women: the policy as a whole is unbiased, but each individual employee is either male or female. In principle the same kind of thing might be true with respect to temporal asymmetry: a time-symmetric physical theory might have the consequence that any individual universe has to be asymmetric in time. (Price [1], p.88)

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[55] The discussion is in part academic, since conditions at the time when the universe has finished expanding and is beginning to contract are likely to be very high entropy/disordered, and generally hostile to low entropy life forms. So it is doubtful that anyone would be around anyway.

This idea solves the problem in a sense. If most universes are individually asymmetric with respect to initial and final conditions, then it is not surprising that our universe is like this. But from Price's discussion it appears that this suggestion has been left quite vague by its proponents. Few details have been offered to flesh it out.

The *anthropic view* is an attempt to mitigate the unlikelihood of the initial conditions thought to obtain at the Big Bang, without thereby making similarly special final conditions less unlikely. The basic idea (also used by Boltzmann to account for low entropy) is that special initial conditions are necessary for our own existence. If these conditions hadn't obtained, then we wouldn't be around to notice them. Hence we shouldn't be surprised (given that we exist at all) to find very special initial conditions. But our existence does not depend on analogous final conditions, so we have no reason to expect them to be so special as well.

The problem here identical to the problem of using the anthropic principle to explain past low entropy. The initial conditions that are suspected to hold in the actual universe are far more special and unlikely than they need to be. Much less unlikely universes would still allow the existence of intelligent life. The anthropic view may reduce the odds, but they are still overwhelming.

The final idea is Penrose's asymmetric law proposal. Penrose's strategy is to reject the idea that the laws of physics are symmetrical:

> ... there must be an additional *asymmetric* law of nature, to the effect that the initial extremities of the universe obey what amounts to a smoothness constraint ... Penrose's argument is that it is reasonable to believe that such a constraint exists, because otherwise the universe as we find it would be unbelievably improbable. (Price [1], p.94)

The problem Price finds with this is simply to question the grounds for proposing that the law is asymmetric. There may be good reason to propose a law to explain the special nature of the initial conditions, but in that case why should the law not also apply to final conditions? Instead of an asymmetrical law which constrains *initial* conditions only, a less *ad hoc* law would constrain conditions at both temporal *extremities* of the universe. Since the Big Bang can be seen equally well (from an atemporal view) as a Big Crunch, there is reason to think that a physical law of the sort suggested by Penrose would apply equally to Bangs and Crunches.

This whole area is of course highly speculative: nothing can be asserted with much certainty. But Price's discussion suggests that a Gold universe is at least an attractive alternative. As I have pointed out, this would have deep implications for the *universality* of all of these asymmetries under discussion. Entropy, knowledge, causation, etc would all operate in reverse (from our point of view) for any intelligent life existing in the contracting phase of the universe.

(xvii) Comparing the Three Approaches

This has been a long chapter with a lot of material. Before suggesting what conclusions can be drawn I will briefly recap the ground covered. The initial problem was to offer some possible accounts of the asymmetries without drawing on the idea of intrinsic direction. Apart from the interest of the accounts themselves, the reason behind this was to show that passage was not needed to provide time with an intrinsic direction.

I have looked at three distinct approaches to the asymmetries in time. Firstly, I looked at the causal approach, where causation was a pivotal asymmetry. This approach split into two variations. On the first version causation was a basic unexplainable asymmetry, since the claim that causes precede their effects was taken to be a necessary *a priori* truth. The problem with this was the conceivability of cases of timeless and backwards causation. On the second version, the causal asymmetry was explained by the fork asymmetry. The problem in this case is that the fork asymmetry only appeared to explain the causal asymmetry *via the concept of explanation*. This began to destroy the whole structure of the causal explanatory map.

Next I looked at the knowledge approach, typified by Paul Horwich. This account had a fair measure of success. Some problems arose when we tried to explain the knowledge asymmetry itself. This was done in terms of forks, but it was not clear how many ordinary cases of knowledge fit into an appropriate fork pattern. A solution to this was offered by distinguishing between how we gain knowledge in particular cases and *why we come to trust these methods of gaining knowledge to begin with*. Another possible problem was that causation was relegated to quite a minor position: there is no real asymmetric causal relation in the world, only symmetrical nomological relations. But on the whole this account achieved an elegant, unified explanation of the asymmetries, the root element being the initial conditions holding at the time of the Big Bang.

Finally I looked at the symmetry approach, using material from Huw Price. This account suggested that there is no asymmetry at all on the microscopic level, and that macroscopic asymmetries are a result of what happens to large numbers of particles given the initial conditions at the start of the universe. It was also suggested that the macroscopic asymmetries might not be absolute (retaining the same orientation throughout all time) but might be *reversed* in the latter half of the universe. The main problem with the symmetry approach is mainly that it is dependent on very speculative ideas from theoretical physics.

The reason for exploring these three accounts was to offer some plausible explanation of the asymmetries in time that needed to make no reference to intrinsic direction of any sort.

I think it is clear that none of the accounts use intrinsic direction to explain the asymmetries. The first version of the causal approach is based upon two basic and unexplainable asymmetries: causation and initial conditions. The second version of the causal approach, and the knowledge approach both need only initial conditions. There seems to be no possible connection between the initial conditions and either intrinsic direction or passage. Perhaps one day some reason might be found to explain why the initial conditions are as they are, but for the moment they simply have to be taken as brute matters of fact. And from the precise nature of these conditions stem all the asymmetries we find about us today.

It is even clearer that the symmetry approach does not require intrinsic direction or passage. It may even be that the two ideas are incompatible. Firstly, if time is intrinsically directed, why is the microscopic level symmetric? Secondly, if intrinsic direction explains the asymmetries, how is it that the asymmetries can be reversed when presumably intrinsic direction remains the same?

Coming to the question of plausibility, since all the accounts have problems, it may be doubted if this aim has been achieved. But in fact all that was necessary was to show that there are alternative explanations of the asymmetries that are *more plausible* than an account derived from an analysis of intrinsic direction in terms of passage. And I think that the above three accounts have done this. Most importantly, the above approaches are far more comprehensive. Passage, for example, seemed unable to explain low level physical asymmetries like forks and entropy. In contrast, the causal and knowledge approaches are all-inclusive. Also, I think it is apparent that the above approaches are far more sensitive and open to the complexity

involved in explaining the asymmetries, and the intricacy of the "internal" relations between them. Although the account I offered in terms of passage could be greatly improved, it seems likely that it would always be comparatively crude.

Secondly, I wanted to show that there are a huge amount of resources available for constructing an account of the asymmetries. The sheer bulk of this chapter is a testimony to this. An original draft of this material was even longer, and included *three* other possible approaches to the asymmetries[56]. Rejecting intrinsic direction does not leave one struggling to think of ways in which the asymmetries might nevertheless be explained.

Overall I conclude that the many asymmetries we find all around us and the apparent "direction" of time do not require passage. Passage would provide time with an intrinsic direction (and is perhaps the most successful attempt to do this) but the only reason to suppose that there is intrinsic direction is that there are so *many* asymmetries. And as we have seen these are better explained without appealing to intrinsic direction at all.

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[56] These were (i) David Lewis' work (see Lewis [1]) linking causation, counterfactuals and the asymmetry of overdetermination (a relative of the fork asymmetry), (ii) David Owen's work linking causation, knowledge, explanation, and overdetermination (some of the material from which was included in the knowledge approach, and (iii) Hans Reichenbach's approach linking entropy, knowledge, explanation and causation.

Conclusions

(i) Summary of the Thesis

Before drawing any definite conclusions, it will be worth recapping the material covered in this thesis. To begin with I introduced the concept of passage, and outlined two simple models of what this passage might consist in: McTaggart-type passage and the moving-now model of passage. Using these models to put flesh on the difficult notion of passage, I looked at three main problems.

In Chapter One, "How Fast Does Time Pass?", I discussed the *rate of flow* argument, asking whether it makes any sense to apply words like "passing" and "flowing" to time itself. On our usual way of speaking, passing and flowing take place *in time*. Talk of time changing was found to be literally absurd. Passage has to be taken metaphorically. But this metaphor is obscure and tenuous: we have little idea what the reality underlying it might be.

In Chapter Two, "Relativity and Passage" I explored implications that current scientific theories have for our ideas about time and passage. In particular I outlined the *relativity of the present* argument, which revealed a difficult conflict between passage and Special Relativity. Because passage is connected with non-relative and often ontological differences between past, present, and future, these properties cannot be easily relativised. This meant that to keep our notion of passage we need to either reject or significantly revise the Special Theory of Relativity. In this chapter I also looked briefly at the *inflexibility argument*, outlining a number of recent physical ideas that sit uneasily with a passage model of time.

In Chapter Three "The Unreality of Time" I explored McTaggart's Paradox, probably the most famous and controversial argument against passage. This argument was seen to be less clear cut than either the *rate of flow* or *relativity of the present* arguments, but still served to highlight the absurdity of applying change to time itself.

In Chapter Four "New Models of Passage" I explored various alternatives to the more traditional ways of conceiving passage. I considered models of passage derived from Prior, Schlesinger, McCall, and Zeilicovici. But none of these models managed to satisfactorily answer the above arguments, and in addition suffered from internal difficulties of their own.

This completed the first part of the thesis. The conclusion I drew at the time was that there are very serious difficulties with passage/tensed time. I suggested that the tenseless/B-Series theory of time might be a better alternative if it could be shown to be plausible. The second part of the thesis was therefore taken up with an exploration of the tenseless theory.

In Chapter Five "Language and the Passage of Time" I examined what sense can be made of our everyday use of tense if there is no metaphysical passage. It was found that the prevalent use of tense in no way implies the existence of tensed facts. Secondly I looked at the distinct and important nature of tensed beliefs like the belief *that it is now raining*. Again, it was found that no tensed facts were needed to explain the truth of these beliefs. Further, Recanati's work provided a (tenseless) explanation of both the special nature and the great importance not only of tensed beliefs but also "spatially tensed" and "person-tensed" thoughts and beliefs. I also argued in this chapter that because of the close analogies between "now", "here" and "I" it is unlikely that any language-based argument could count against the tenseless view of time without also implying that space or people somehow "pass".

In Chapter Six "Miscellaneous Problems" I looked firstly at whether the tenseless view of time is compatible with our freedom. The tenseless view *is* committed to what I called *logical determinism* (there are "fixed" future truths), but I argued that this has no implications for our level of freedom. Secondly I looked at a problem with persistence through time. The tenseless view has been held to imply perdurance and temporal parts; temporal part in turn have been regarded as incoherent. I argued that the tenseless view is perfectly compatible with endurance; and that even if we accept perdurance there are no serious problems.

In Chapter Seven "Our Experience of Passage" I explored the experience we have of time passing, and asked if this sense of passage could be explained if there is no metaphysical passage. I offered a combined explanation of our sense of passage in terms of our misuse of language, our large-scale temporal experience, our small-scale temporal experience, and the direction of time (especially the knowledge asymmetry). The result was an apparently plausible tenseless account of our sense of passage.

In Chapter Eight I looked at whether time has an intrinsic direction; and at whether passage was needed to provide this direction. Passage was indeed found to be the best candidate for providing time with an intrinsic direction, but it was still a very poor option. The main reason for supposing that time has an intrinsic direction was the number of pervasive asymmetries we find all about us. I suggested that these asymmetries could be accounted for without invoking the difficult notion of intrinsic direction.

In Chapter Nine I looked in detail at three approaches to asymmetries such as knowledge, causation, value, and action: the *causal approach*, the *knowledge approach*, and the *symmetry approach*. This discussion showed that there are plausible ways to account for the asymmetries without recourse to intrinsic direction. The key was found to be the initial conditions holding at the time of the Big Bang. The discussion also revealed the *wealth* of resources available to anyone trying to give an inclusive, unified account of the asymmetries and the interdependencies between them. Whichever account in actually true, it seemed clear that intrinsic direction would not be needed. Therefore it is unlikely that matters to do with the direction of time require a passage model.

(ii) Conclusions

It will probably have become clear during the course of the thesis where my own sympathies lie. I think that the above summary shows that the scales are heavily tipped in favour of a tenseless, passageless, theory of time.

On the one hand, although passage appears to be such an integral and important part of our concept of time, passage models of time are riddled with very serious problems. These problems can be met at a cost. But it would only be worth accepting a *deep obscurity* and *revising or rejecting Special Relativity* if there were no plausible alternatives.

There does seem to be a plausible alternative, though. From Chapter Five through to Chapter Nine I have looked at a wide variety of possible

objections to a tenseless theory of time, from the pervasive of tense in our language, through to our experience *as of* passage, and even the direction that time appears to have. In each case, I think, a plausible response has been made.

The problems with passage therefore far outweigh those of the

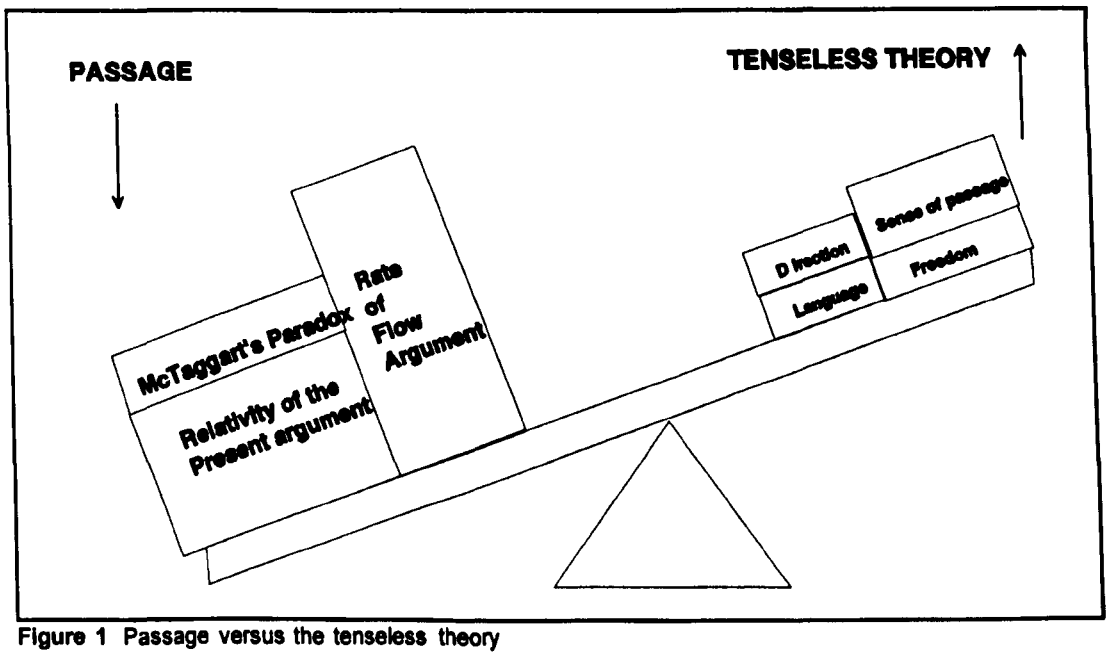

Figure 1 Passage versus the tenseless theory

tenseless theory of time. See the figure 1. I conclude then that time is tenseless. Firstly, there are no real intrinsic distinctions between past, present and future: rather all times and events are equally real. Secondly, there is no flow or dynamism: time is a "static" ordering of moments and events according to the relations earlier, later and simultaneous with.

But for all the arguments of this thesis, it may still be hard to believe that there is really no passage. Over the last few pages I want to briefly suggest some reasons for our strong belief in passage and where this idea might have originated from.

(iii) Sources of Our Concept of Passage

Throughout this thesis I have taken passage to have two main features. Firstly, there are intrinsic differences between past, present and future, where these differences are probably related to the type or degree of reality belonging to each region. In particular, the "now" or present moment is taken to have a privileged status. Secondly there is a change between these regions. Which moments and events are past, present or future changes. There is some sort of "dynamism" involved. The extended discussion of the direction of time has also served to emphasize that this change is *directed*, that the "now" moves away from the past and towards the future.

Why is this concept of passage so compelling? Up to a point, the sources of our concept of passage exactly parallel the series of objections made against the tenseless theory of time: the pervasiveness of tense, the importance of tensed belief, the belief in human freedom, the belief that we persist in time by "moving" from one time to the next, our vivid experience *as of* time passing, and the marked direction shown by various phenomena within time.

Firstly, then, there is the pervasiveness of tensed ways of talking, and the importance of tensed belief, both of which appear strongly indicative of passage. There are real differences between the past, present, and future tenses, and between beliefs like "it *was* one o' clock", "it *is now* one o' clock" and "it *will be* one o' clock". And especially in the case of tensed beliefs, our beliefs about what is happening now ("now-beliefs" as we might call them) have a very distinctive and important nature. Now-beliefs have an essential link to action. My belief that a meeting I need to go to is starting *now* is what galvanises me into action. The suggestion is that these real differences in language and belief are mistakenly *transferred* onto the way time is in itself.

Language and belief are also linked to the dynamic aspect of passage. It is only appropriate to say the sentence "it is *now* one o' clock" at certain times. In other words, sometimes this sentences expresses something true, but sometimes it expresses something false. Again this is a real difference, linked to the indexical nature of the word "now". Again the suggestion is that this kind of change is illegitimately transferred onto a time which in itself is tenseless and "static".

It is worth asking *why* our language and belief are structured like this. The discussion of Recanati showed that this goes back to the limited perspective we have on the world. All our experience and perception is

limited by who we are, where we are, and when we are. In Recanati's terminology, our experience and thoughts are heavily structured in terms of *ego*, *hic*, and *nunc*. It is inevitable, given the way we are made and the way we perceive things, that the present moment should always have a very special significance to us.

This limited perspective has an important role to play, but we need to ask why we don't also conceive of space and people passing, since thought is structured just as much by *ego* and *hic* as it is by *nunc*. This probably stems largely from the distinctive nature of our temporal experience. Our vivid sense *as of* time passing is one of the central reasons for our concept of passage. The interplay of memory, present experience and expectation on the large scale, and the differing contents filling the same experiential framework on the small scale, makes us *feel* as if we are moving forward into the future. But, as I have argued, this feeling is quite understandable on a tenseless view.

The strong directedness of time will also play a part in our sense of passage. As I have mentioned, Grünbaum has argued that there is a tendency to conflate questions about passage with question about direction. The question "does time have a direction?" easily becomes "does time have an arrow?" which in turn becomes "is there a one way, forwards progression of times and events?". Again, having confused the issues of direction and motion, we impose a forwards progression onto time that it does not really have.

The discussion of the asymmetries in time suggest some other very interesting connections between passage and direction. I noted in Chapter Eight that at first sight passage offers a way to understand some of the more human asymmetries like knowledge, decision, value, explanation, etc. But a problem was that passage offered no clue to physical asymmetries like forks and entropy. I think we are now in a position to understand why this is.

My idea is that our concept of passage is in part *a reflection of the human asymmetries*. There *are* genuine links between passage and the human asymmetries, but it is the asymmetries that help explain our concept of passage rather than the other way around. To see this, notice how similar distinctions made in passage metaphysics are to distinctions within our knowledge. On a standard passage model, only the present is fully real; the past is real in an attenuated sense, and fixed in its content; the future is only semi-real, a realm of possibility. Compare this with three divisions in our knowledge: current perceptions, memories, and expectations. See figure 2.

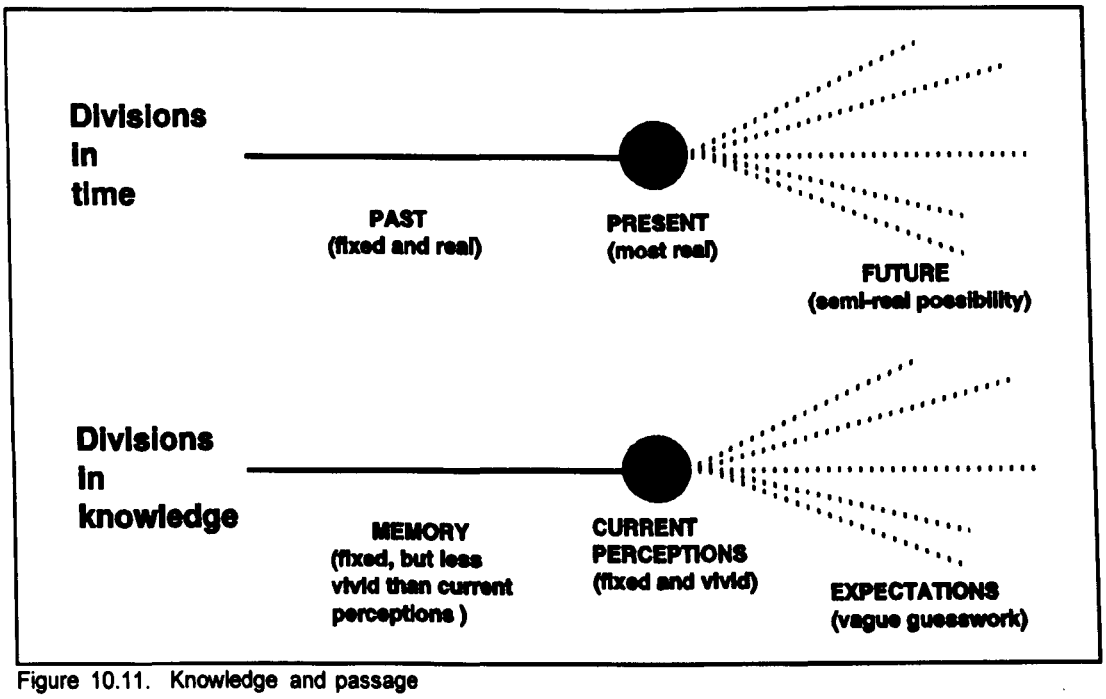

Figure 10.11. Knowledge and passage

The knowledge we have from our current perceptions is the most vivid and certain sort of knowledge that we have. If I see a table in front of me that I cannot doubt at least that I *seem* to see a table. Memory-knowledge is less vivid than this. Although memory gives us definite and detailed knowledge, this knowledge is less sure and overwhelming. My memory is more distant and vague than current perceptions. Finally expectation is a hazy affair. My knowledge of the future is a rough sketch of expectations and guesswork, with many of its details not yet filled in.

The links between the three divisions in tensed time and the three divisions of knowledge are suspiciously close. My suggestion is that it is the divisions in knowledge that provide the model for the divisions in time. In other words, although time is tenseless, our own limited knowledge leads us to superimpose the regions of past, present and future on top of the objective tenseless ordering. Past, present and future are just a reflection of our epistemological biases.

Knowledge, of course, is not the only asymmetry involved, although it is probably the most important. All the other asymmetries connected with knowledge will play their part in forming our concept of passage. The biases in decision, value, action, causation, explanation etc are reflected in and reinforce our idea and experience of passage.

Action and decision are particularly interesting because of their link with human freedom. As with knowledge, there is a suspicious similarity between

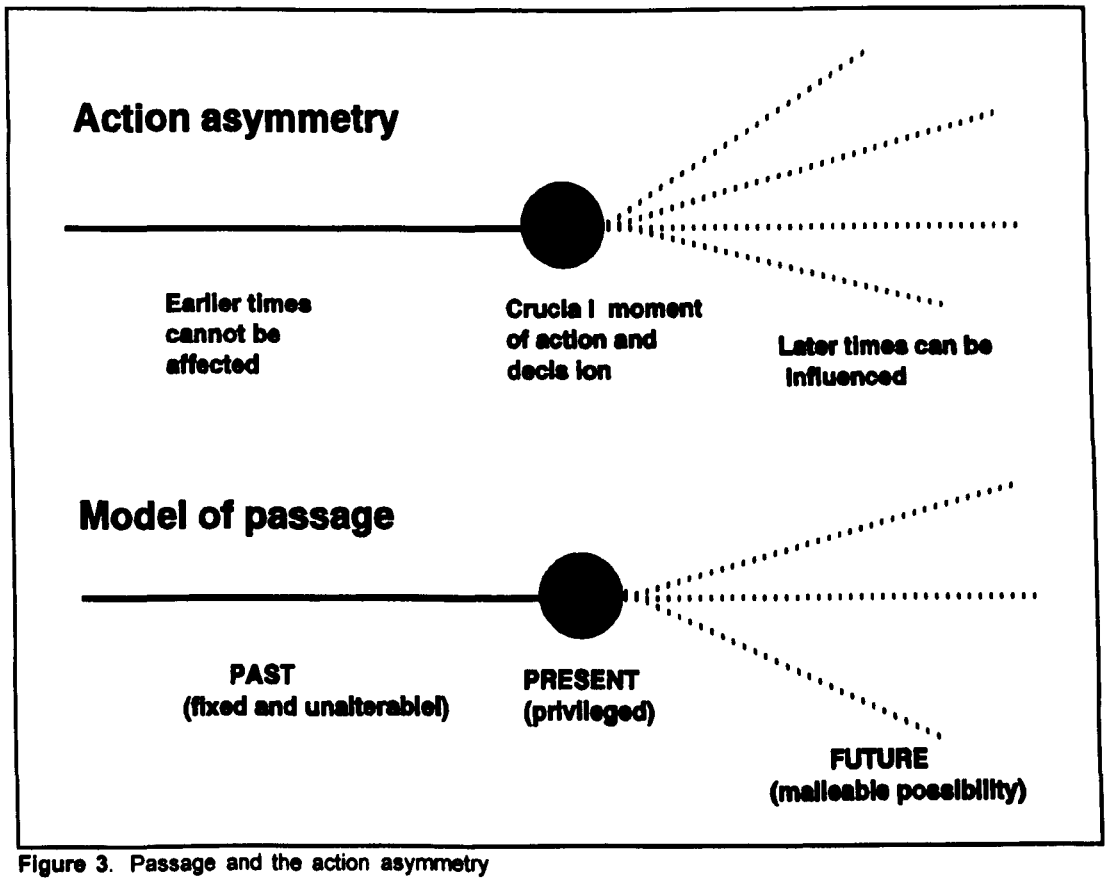

Figure 3. Passage and the action asymmetry

the structure of action and the structure of passage. With regards to action, earlier times cannot be affected: *they are unalterable*. Later times can still be influenced: our actions can play a part in what occurs at these later times. The current time is the crucial moment of actually making a decision and acting on it. This again seems closely linked with threefold structure of passage: fixed, unalterable past; malleable, open future; and privileged present. See figure 3.

All of these factors (tensed language, tensed belief, our limited perspective on the world, our vivid sense *as of* time passing, the felt direction of time, and asymmetries in time such as knowledge) contribute towards our common belief in passage. The combined force of them make it hard to believe that there really is no passage. But I have tried to show all of these phenomena are perfectly understandable on a tenseless view of time. By reflecting on the many difficulties faced by passage, and on the tenseless explanations of tense, our experience of passage, the direction of time, etc. the persistent idea of passage may begin to lose its hold.

The End

Appendix A

The Inflexibility Argument

The *Inflexibility argument* against passage, as outlined in Chapter Two, is roughly that many new ideas in physics sit uncomfortably next to a traditional passage view of time. In this appendix I include details of some of these ideas, which were only listed in a table in Chapter Two.

(i) General Relativity: Closed Time and Wormholes

There is no space here to give more than the roughest outline of General Relativity, which is even more complex that the Special theory. Apart from anything else a proper presentation would first require a lengthy discussion of geometry. For fuller details about General Relativity I refer the reader to Sklar [1], Chapters II and IV.

Very crudely, the idea is that the distribution of mass in the universe affects the very structure of spacetime. Again, one way to approach this is to look at the behaviour of light. Einstein supposes that light rays travel along what are called *geodesics*. A geodesic is a concept taken from geometry - roughly it means the shortest line between two points. Often this will be a straight line; but if we imagine insects crawling around on the surface of a large sphere the shortest route between two points is an *arc*. Einstein's idea is that large masses *bend* and *distort* spacetime. Since light travels along geodesics, light rays will follow the contours of these distortions. This idea has since been experimentally confirmed - light passing near to large bodies of mass actually bends slightly.

This bending of spacetime opens up some fascinating possibilities. One solution to the equations of General Relativity is a model of spacetime in which time is *closed*. The notion of closure is a mathematical one (or more precisely a *topological* one). The rough idea can be grasped by comparing a line and a circle. A line can be extended indefinitely in either direction without end. It therefore has the topological property of being *open*. But a circle closes in upon itself - travelling around the circle will eventually bring you back to where you started. Thus the circle is *closed*. If time is closed, there is the bizarre possibility that if one lived long enough (several billion years or more!) one might come full circle in time. The distant future (several billion years later than now) would gradually turn out to be the distant past (several billion years earlier than now). This is graphically illustrated in the *cylinder world* shown in figure 1. Space is contracted to one dimension and runs along the length of

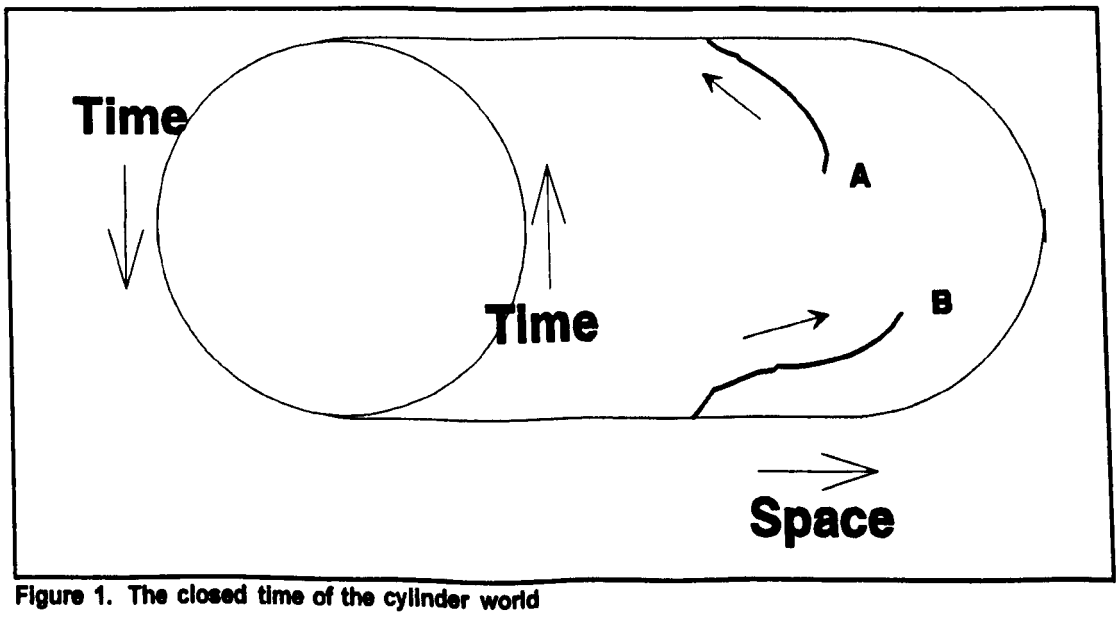

Figure 1. The closed time of the cylinder world

the cylinder. Travelling *around* the cylinder is the time dimension. A sufficiently long-lived person might therefore eventually find themselves in their own distant past.

This idea - which is a physically possible solution to the equations of General Relativity - sits very uncomfortably with traditional ideas about passage. The main problem is that every event in the past is also in the future, in the sense that if we wait long enough we will eventually arrive at these events. By the same token every event in the future is also in the past, since if we cast our thoughts back far enough into the past we will find ourselves looking at the distant future. In terms of the cylinder world we can reach any past event by travelling anti-clockwise in the future direction; and any future event by travelling clockwise in the past direction. In other words, if time is closed every event is both past and future. But on a traditional view of passage these two properties are incompatible: there is a world of difference between a fixed real past event and an unfixed possible future event.

Another even more strange possibility opened up by General Relativity is the idea of a wormhole. Since large masses distort spacetime, what will happen around incredible masses like Black Holes? Clearly spacetime will be distorted to an extreme degree. It has actually been seriously suggested that the centre of a Black Hole may form a wormhole to a completely different region of spacetime. Kip Thorne in particular, a respected American scientist, has written several papers exploring how an advanced civilisation might create a stable wormhole to connect two points of spacetime.

Again the consistency of this suggestion with General Relativity sits uncomfortably with passage and tensed time. The two points connected by the wormhole may well be widely separated in time. But presumably both the times connected by the wormhole must be equally real. How could one connect a faded past time to a not-yet-existing future time? Even more strikingly, suppose signals could be sent from one end to the other. If we accept the tensed view, then people who are present could communicate with people who are past and gone, or with future people who do not yet exist. This just seems silly: although the suggestion is based on the accepted physical theory of General Relativity, the tensed view of time makes it seem absurd.

(ii) Quantum Theory: Backwards Causation?

Again, I offer only brief details about quantum theory - for proper discussions see Squires [1], Davies [1], or Price [1], Chapters 8 and 9. The key suggestion I am interested in is the idea that some sort of "backwards causation" (of causal signals travelling backwards in time) helps solve some of the many puzzles of quantum theory.

The necessary background to understand this suggestion is to note that in quantum theory the behaviour of a particle is described using a *wave function*. Roughly the wave function reflects the probability of the particle being in different locations or moving with a different velocities. Heisenberg's famous uncertainty principle says that we cannot be sure both exactly *where* the particle is and exactly what its *momentum* (its mass times its velocity) is. If we measure the position precisely, we cannot be sure of the momentum; if we measure the momentum precisely we cannot be sure of its position.

Suppose then that we measure the particles position. We will now be unsure of its momentum - in other words we will be unsure how fast it is travelling and in what direction. This means that at any later time we will be unsure again about *where* the particle - we can't be sure of where is has moved to.

We can chart the possible positions in which the particle might be in terms of a wave function. This wave function will indicate for each point of space in the region the probability that the particle is at that point. But the odd feature is that these wave functions do not just chart our knowledge. They do not just reflect the fact that for all we know the particle could be in any number of places, but that it is more probably in place x than place y. Rather, the wave functions appear to reflect a genuine vagueness in reality - the particle is in a sense spread out across all its possible locations. This strange idea is strongly confirmed by the experimental fact that these wave functions *interact*. And if they interact then surely they must be part of reality.

If we now measure the position of the particle, then this wave function *collapses*. The measurement is held on many interpretations to create a fixed precise reality instead of the

vague spread out reality associated with the wave function. The imprecise wave function charting the possible positions of the particle collapses to a single position which the particle definitely occupies. (This will again make us unsure of the momentum, and so a new wave function will begin).

There are many puzzles about how to interpret quantum theory. But there are two puzzles I am particularly interested in here.

The first comes from reflecting more on the act of measurement. The nub of the problem is this. If the measuring system that is used is itself a quantum system (i.e. describable by quantum mechanical laws) then a measurement could not make the wave function collapse as required. All that would happen is that the wave function becomes more complex. See Squires [1], Chapter 3 for an explanation of why this is. Some scientists have argued that this means that the wave function never collapses. Their attempt to explain why it appears to collapse leads to a bizarre metaphysics in which the future splits into many branches and every possibility in realised in at least one branch.

Another solution has been to suggest that *consciousness* can be regarded as the necessary non-quantum measuring system. In other words, the act of someone consciously observing events is what collapses the wave function.

The relevance of this solution to our ideas about time can be vividly brought out by thinking about events in the early universe *before conscious observers existed.* It may be that it is only now, using modern technology, that some of these events are being observed by conscious beings. If consciousness is necessary in order for wave functions to collapse, this suggests that until recently these early events were "vague", described only by an uncollasped wave function. *A contemporary act of conscious observation therefore might have the effect of collapsing a wave function describing events billions of years ago*[1].

The point here is not that this is the best or only interpretation of quantum theory. But it is an interpretation that has been seriously put forward. This idea is clearly in conflict with a traditional model of passage in which the past is fixed and settled. Instead large chunks of the past are still only described by an uncollasped wave function. In other words, much of the past has a fluidity usually associated with the *unrealised possibility* of the future.

The second relevant puzzle is to do with a famous class of experiments called the EPR-experiments. The name "EPR" stands for Einstein-Podolsky-Rosen, the three scientists who first introduced them.

One property that a particle can have is *spin.* Supposing that a particle has a spin of zero and then splits into particles A and B, there is a rule that spin must be conserved. In other words, the spin of A added to the spin of B must equal zero. There is also a rule that the spin value of either A or B must be +1/2 or -1/2. There will be wave functions describing the evolution of both A and B, and the spin value of each particle will be one factor in these functions. Suppose that we let A and B travel until they are a large distance apart. Then we measure the spin value of A. This act of measurement collapses the wave function describing the spin of A. In other words, the measurement tells us that A has a spin of +1/2.

The important point is that we are assuming that before this measurement (before the wave function collapsed) there was no definite fact of the matter about the spin of either A or B. The measurement "makes it" a definite fact that A has a spin of +1/2. But this measurement will also effectively collapse the wave function describing B. Since spin must be conserved, B must have a definite spin value of minus 1/2.

The puzzle is that an act of measurement on A *appears to have an instantaneous effect on spatially distant particle B.* There are in fact two problems here. Firstly, a causal signal must somehow travel *infinitely fast* to reach B as soon as the measurement is made of A. But this is in direct conflict with Special Relativity which says that no signal can travel faster than light. Secondly, there is no *chain* of effects running from A to B. Nothing about the measurement on A instantaneously affects anything in the region between A and B. In other words, we seem to have a *non-local* effect - the effect upon B.

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[1] There are alternatives, even on the assumption that consciousness is needed to collapse wave functions. One suggestion that has been made is that *God* is conscious of whatever happens and is responsible for the collapse of wave functions. Another suggestion is that consciousness is more ubiquitous than we usually think - perhaps some sort of rudimentary consciousness exists in so-called "inanimate" measuring systems, or even at the level of particles themselves.

There are different responses to this. Einstein's own was to conclude that the idea of an act of measurement collapsing wave functions is wrong[2]. But another suggestion is in fact to modify our ideas about time. Ordinarily we would feel that the way the particles split and the act of measurement we decide we are going to make are independent facts. When the particles split we don't feel that the way in which they split is in any way affected by the measurement *which we are going to make.*

But suppose that "causal" signals can operate both *backwards and forwards in time.* When we measure the spin of particle A, this act has the effect of collapsing the wave function of A *back to the point where the original split took place.* There is a chain of local effects leading backwards in time to the original split; and this chain can then carry on forwards along a chain leading to the collapse of the wave governing B.

Again, this is only one possible suggestion. The point is that the oddities of quantum theory may lead us to revise our ideas about time. As Euan Squires points out, the puzzles and mysteries of quantum theory suggest that:

> ... we may have to move further from the conventions of classical physics, to free our minds from ... inbuilt prejudices ... [and] be released from our restraints regarding time and space (Squires [1], p.133)

(iii) Richard Feynman: Two Novel Theories

There are two interesting theories, relevant to time, both of which Feynman has had a central role in. The first is the *Wheeler-Feynman absorber theory* which is about the radiation of light and other waves; the second is a proposal suggested by Feynman that positrons can be regarded as electrons *which are moving backwards in time.*

In the 1940's, in response to difficulties to do with what happens when charged particles are accelerated[3], Wheeler and Feynman made some proposals about the radiation these charged particles emit. Roughly, the idea is that individual charges emit radiations *both forwards and backwards in time.* More precisely, a radiation wave propagated outwards from the source-particle in the usual "forwards" way is called a *retarded* wave. A wave propagated by the source-particle that appears as an wave moving towards rather than away the source is called an *advanced wave.* Since an advanced wave moves towards the source, the "beginning" of the wave at points distant from the source is at an earlier time. The source therefore generates a wave that begins backwards in time.

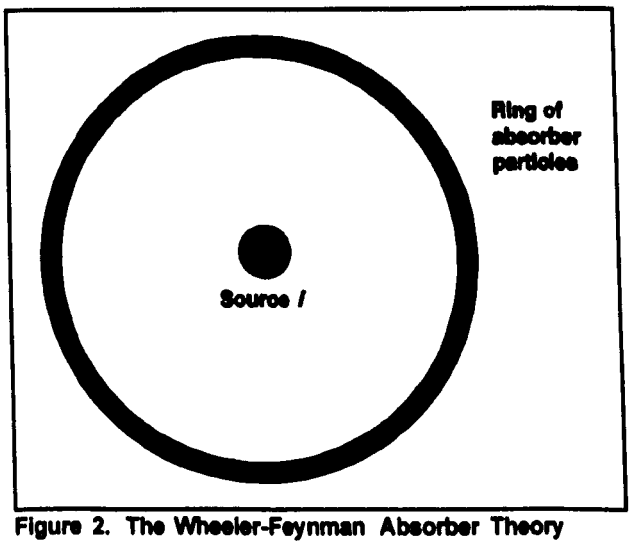

Figure 2. The Wheeler-Feynman Absorber Theory

But why we do apparently only see ordinary retarded waves? Wheeler and Feynman suggest an answer in terms of the set up in figure 2. A charged particle *i* emits a concentric series of retarded waves outwards towards the outer ring which absorbs the waves. According to Wheeler and Feynman's suggestion, *i* also generates a concentric series of advanced waves closing inwards towards it. The absorber particles will also be

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[2] Einstein preferred what is now known as the *hidden variable* interpretation of quantum theory. On this view, the wave function is merely a description of our knowledge. The actual reality is fixed by quantities that are hidden from us. This view has not often been too popular. Various problems (such as accounting for the apparent interaction of wave functions) require the postulation of a strange *quantum force*, and other theoretical complexities. And in any case the essential problem still remains - the mathematician John Bell proved in the 1960's that any hidden variable theory would also be committed to this puzzling sort of non-local action-at-a-distance.

[3] See Price [1], p.65 for more details.

generating both retarded and advanced waves. More precisely, Wheeler and Feynman claim that the source generates a radiation field of *1/2 retarded + 1/2 advanced*; and that the absorber generates a field of *1/2 retarded - 1/2 advanced*. Combining these fields gives a result of one full retarded wave coming from the source. In other words, after the radiation waves from source and absorber have interfered, the advanced waves cancel out, leaving a normal retarded wave of the sort we generally observe.

The second theory is Feynman's hypothesis that positrons can be regarded as electrons moving backwards in time. See Horwich [1], p.104-5; and Ray [1], p.164-165. This is best explained using the diagram in figure 3. Feynman's claim is that the situation shown in figure 3 (a) could also be interpreted as being 3 (b). In the first case a gamma ray decays into an electron and a positron. The positron then collides with another electron and another gamma ray is produced. In the second case the electron on the right of the picture moves forwards in time, emits a gamma ray and then begins to move backwards in time (appearing as a positron). The backwardly moving electron then absorbs a gamma ray and begin moving forwards in time again.

Whether either of these theories are accepted as true is largely a matter for physicists[4]. The point is again that these ideas make little sense on a traditional passage model of time. How can a present radiation source make it the case that at a past point of time there was an incoming wave approaching? How can a present electron ignore the universal passage of time and follow its own sweet way into the past? Theories which, in the context of physics, have some plausibility and might even be true, appear to be incompatible with a tensed view of time.

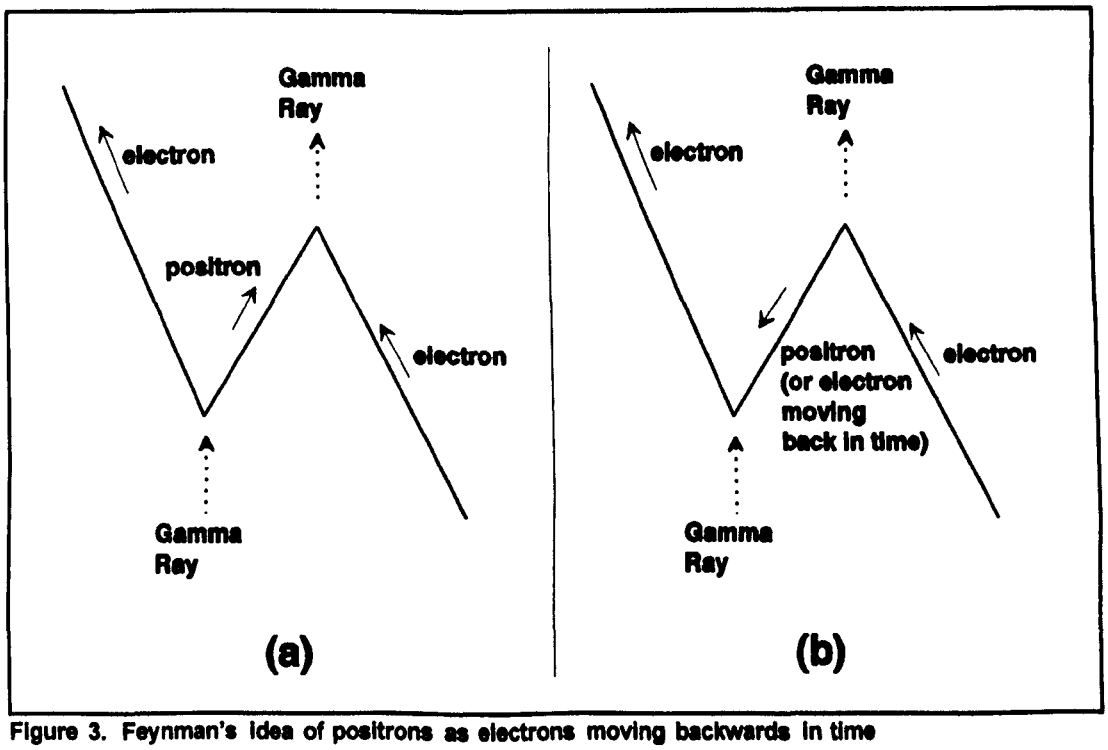

Figure 3. Feynman's idea of positrons as electrons moving backwards in time

[4] Though at this level of speculative physics, the distinction between philosophy and physics becomes less clear. Philosophers of science may therefore be in a position to make helpful points about some of these theories.

Appendix B

Spacelike Time

(i) Introduction

It is sometimes claimed that the tenseless view takes away from time one of the main features which distinguishes it from space i.e. *passage or flow*, and in effect makes time into little more than a form of space. How does denying passage make time like space?

On one tensed characterisation of time, time is taken to have a unique privileged moment - the *Now*. In an inexorable process each moment of time is successively *Now*. Future time may be thought of as merely a realm of possibilities; past time as a realm of fixed reality, but only a dead relic, no longer lit by the active reality of the present. Nothing like this can be said of space. *Here* (where I am now) is no more privileged then any other point of space. This unprivileged *Here* need not shift in an inexorable progression from left to right or from north to south. Places to the left and places to the right are not thought to be different in regard to reality: objects to the right being hazy possibilities and objects to the left rigid but lifeless relics. But the tenseless view argues that in this respect time is exactly like space: "now" is no more privileged or "moving" than "here" is.

Passage is often taken to be one of time's most distinctive features. If this is taken away - if time is like space in that neither time nor space pass - what is left to keep time distinct? Some people have concluded from this sort of reasoning that tenseless time just a sort of space at "right angles" to the three spatial dimensions? As the Time Traveller in H.G. Wells' "The Time Machine" says:

> There are really four dimensions, three which we call the three planes of Space, and a fourth, Time. There is, however, a tendency to draw an unreal distinction between the former three dimensions and the latter ... Scientific people know very well that Time is only a kind of Space ... (Wells [1], p.4)

The belief that the tenseless view makes time only a sort of space is one reason to doubt tenseless time. This is because there are many examples suggesting very significant differences between time and space. If the tenseless view of time cannot account for these differences, then the tenseless view must be false.

In this Appendix I will be asking two questions:

(i) How alike are space and time?

(ii) Can any genuine differences between time and space be accounted for if time is tenseless?

(ii) Differences Between Time and Space

At first sight there are apparently many genuine differences between time and space. See for example the list of differences between time and space given in the table on the next page (taken from Taylor [1], Gale [3], and Garson [1]). If time is really like space, how can these differences be accounted for?

On the surface, however, there is no particular reason to think that the tenseless view is committed to the claim that time and space are alike in every respect. The claim is simply that time and space are similar in at least one respect: *in neither case is there any metaphysical passage or flow*. Any differences not connected with passage are consistent with tenseless time. But it may be argued that many differences can only be accounted for if time really does pass.

SOME DIFFERENCES BETWEEN SPACE AND TIME
My next use of "now" must denote a different time from my last use of "now"; but my next use of "here" need not denote a different place from my last use of "here"
An object cannot be in two places at once; but an object can be at two times at only one place (i.e. by remaining where it is)
An object can move back and forth in space but cannot move back and forth in time
Only variation over time is genuine change - variation across space e.g. along a line of latitude, or along a row of houses - is not genuine change.
Given two non-simultaneous events x and y, either x is earlier than y or y is earlier than x; but given two non-coincident events x and y it is does not have to be the case that x is to the left of y or y is to the left of x (since x and y might be on the same left-right line, but above or below each other)
A person may deliberate about what to do at a later time but it is pointless for them to deliberate about what to do at an earlier time; the corresponding spatial analogy does not hold - e.g. a person can equally well deliberate about what to do the left (north, above, etc) of here as about what to do to the right (south, below, etc) of here

For instance, it seems to be clearly true that my next use of "now" must refer to a different time than my last use - I am never able to say "now", then wait a while and use "now" to refer to the same time as before. But I can do this with "here", simply by staying in the same place for a while and using the word "here" a few times. But it might be thought that surely this is just because time passes. Time's inexorable passage binds me to move at a steady rate through time, whereas I can stay still or move around as I wish in space.

If this is so, then at least one apparent difference between time and space is grounded in passage. It follows that the tenseless view cannot capture a real difference between time and space.

(iii) Spatial and Temporal Analogies

But the first problem is in fact to sort out which of the suggested differences are genuine and which are not. It has been seriously argued that a great number of them only appear to be differences because of certain prejudices we have. As Taylor writes:

> ... temporal and spatial relations, contrary to much traditional thought, are radically alike ... terms ordinarily used in a peculiarly temporal sense have spatial counterparts and vice versa, and ... many propositions involving temporal concepts which seem obviously and necessarily true, are just as necessarily but not so obviously true when reformulated in terms of spatial relations; of, if false in terms of spatial concepts, then false in terms of temporal ones too. (Taylor [1], p.381)

In the above table, each example has the following form. Firstly there is a *temporal claim* e.g. that my next use of "now" must refer to a different time, or that an object cannot

be at two places at one time. Then there is a suggested *spatial analogy* of this claim e.g. my next use of "here" must refer to a different place, or an object cannot be at two times at one place. And in each case it is held that the spatial analogy does not hold. In considering whether a difference is genuine or not the key is to find the correct spatial analogy of the given temporal claim. But it is not always obvious what the correct analogy is.

Consider the first example in the list: my next use of "now" must denote a different time from my last use of "now"; but my next use of "here" need not denote a different place from my last use of "here" (see Garson "Here and Now"). Breaking this down gives:

> Temporal Claim: my next use of "now" must denote a different time from my last use of "now"
>
> Spatial Analogy: my next use of "here" must denote a different place from my last use of "here"

The spatial analogy is clearly false: I can say "I am here" in one place at time t(1) and then say "I am here" in the same place at time t(2). But the suggested spatial analogy is not the right one. The basic idea in constructing the analogy was to replace all the temporal concepts in the first claim with spatial concepts: "here" replaced "now", "place" replaced "time". But not all the temporal concepts were replaced: the phrases "my next use" and "my last use" implicitly refer to time. That is "my next use" is taken to mean "my use at a later time" and "my last use" as "my use at an earlier time". This means that the full temporal claim and the corresponding spatial analogy are as follows:

> Temporal Claim: my use of "now" at an earlier time must denote a different time to my use of "now" at a later time
>
> Spatial Analogy: my use of "here" at one place[5] must denote a different place to my use of "here" at a different place

This spatial analogy is just as true as the temporal claim: the root source in both cases is simply that my use of both "now" and "here" refer to different times and places according to where they are used.

As well as taking care to find the correct spatial analogy of a temporal claim, another thing to be careful of is that many apparently non-temporal concepts actually have a built-in

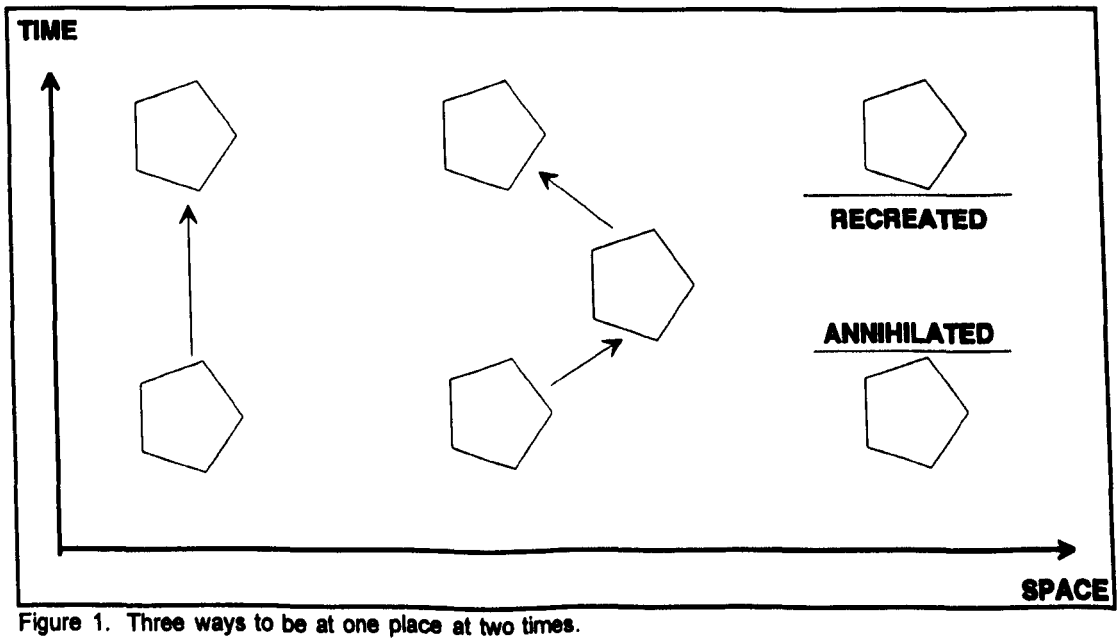

Figure 1. Three ways to be at one place at two times.

[5] In this analogy I simply say a "different" place. To make the analogy slightly closer one could say "at a place to the left of here" or "at a place to the north of here", where the spatial ordering of objects from left to right, or from north to south, replaces the temporal ordering from earlier to later.

bias between time and space. Again the easiest way to show this is by another example from the list (see Taylor, p.383): an object cannot be at two places at one time, but can be at two times at one place (e.g. simply by remaining where it is for a period of time). Again the first step is to be clear exactly what is being asserted. Taylor suggests that there are three ways for an object to be at two times at one place. Either it can remain where it is for a period of time; or it can be at place s(1) at t(1), move elsewhere, and then return to s(1) at t(2); or it can be at s(1) at t(1), be annihilated, and then recreated to be at s(1) at t(2). See figure 1.

Are there spatial analogies for each of these cases? The analogy to the first case is in fact obvious once it is said: any spatially extended object occupies more than one place at any one time, simply by virtue of extending over a certain stretch of space. A chair is clearly at more than one place at any one time: one leg will be in one place, another leg in another place, and so on. The only objection to this analogy would be that whereas in the temporal case objects *wholly occupy* each time which they are at, in the spatial case it is only *parts* of the object that occupy each place. But from the discussion of the first half of this chapter it is clear that on the tenseless view objects do not wholly occupy each time - at each time there is only a *temporal part* of an object.

The second case was an object which is at s(1) at t(1), at other places afterwards, and then back at s(1) at t(2). If the spatial analogy is to hold then we need an object which could be at t(1) at s(1) and at t(1) at s(2), but at other times at places between s(1) and s(2). Taylor suggests that examples of this seemingly unlikely description are more commonplace than might be thought. For instance a loud roll of thunder might be heard in three towns: town A at s(1), town B at s(2), and at town C in between s(1) and s(2). Depending on the source of the roll of thunder it might arrive in town A and town B at t(1), but arrive in town C at some other time. See figure 2. Any widespread sound of this sort could clearly satisfy the description. Again the objection might be made against this analogy that a roll of thunder is not a proper object. For Taylor this objection rests on prejudice in our notion of identity and

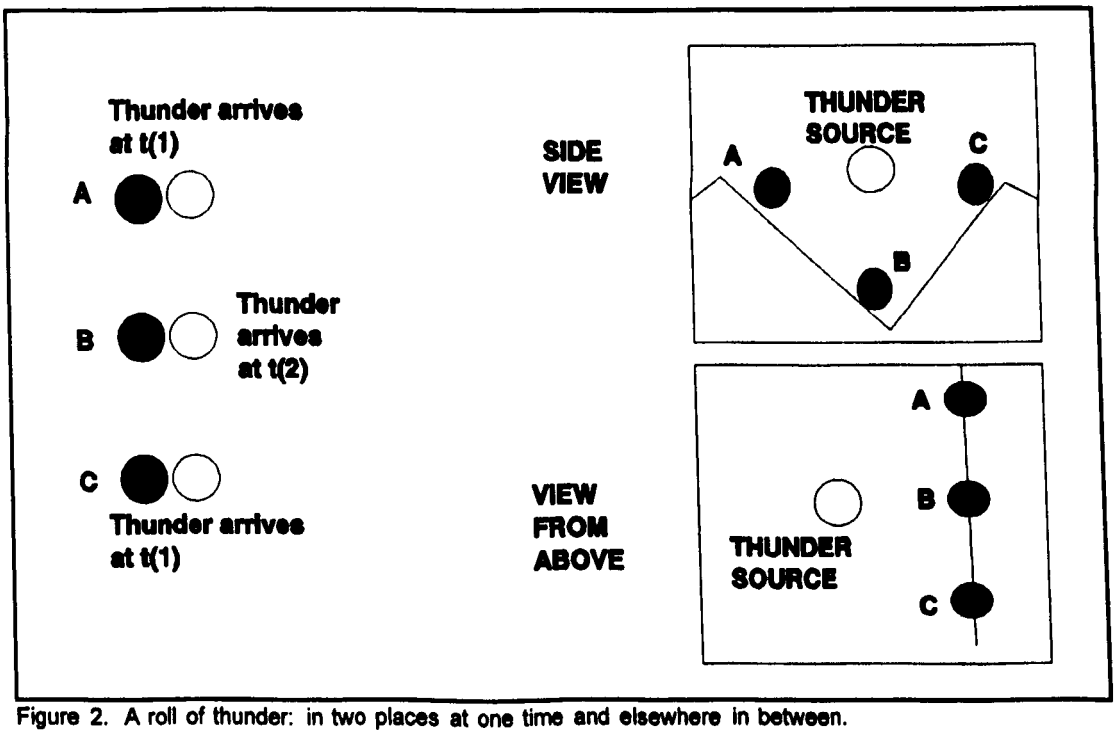

Figure 2. A roll of thunder: in two places at one time and elsewhere in between.

what constitutes an object:

> One might want to insist that several objects or events are involved in this case ... but this would only betray a prejudice in the common notion of identity. (Taylor [1], p.384)

This case also throws doubt on another example in the list - an object can move back and forth in space but not in time. The key point is that when an object moves back and forth

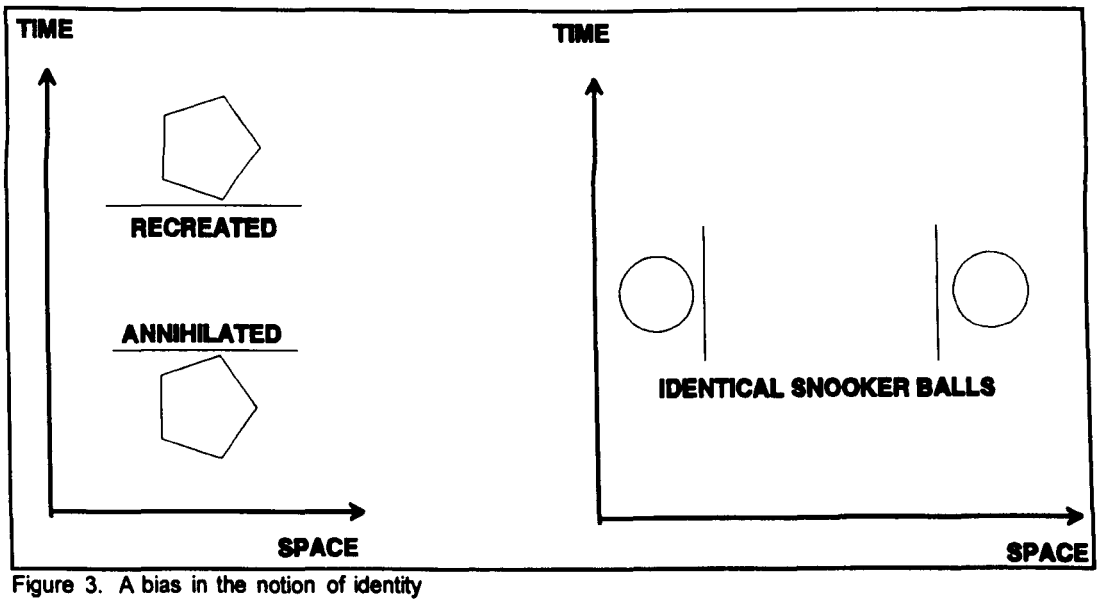

Figure 3. A bias in the notion of identity

in space it does so with respect to time (i.e. over time). So an object that moves back and forth in time will do so with respect to space. Taylor's roll of thunder does just this. At s(1) it is at t(1), at s(2) it is at t(2) and at s(3) it is back at t(1) again.

The final case (an object which is at s(1) at t(1), is annihilated and then recreated at s(1) at t(2)) is analogous to a case in which an object is at t(1) at s(1) and at t(1) at s(2), but does not exist anywhere in between. As an example of this Taylor suggests simply two identical snooker balls at different places on a snooker table. The immediate objection is that *two* balls are involved, not just one. But Taylor then asks why the object that is annihilated and then recreated is regarded as one object instead of two. In both cases the objects are identical (the recreated object is exactly similar to the annihilated one and the snooker balls are exactly similar). The only difference is that in one case there is a temporal separation; in the other a spatial separation. See figure 3. To assert that one object is involved in the temporal case, but two in the spatial case, is according to Taylor a straightforward prejudice.

The interest of these three cases is that in each instance the suggested difference appears to rest on a bias or prejudice which would need to be supported by further argument. In the first case the bias is to regard objects as wholly existing at each time, but having only a small spatial part existing at any one place. But I have argued that it is coherent to regard only a small temporal part of an object existing at any one time. In the second case the bias is to doubt that a widespread sound like a roll of thunder can constitute a single object in contrast to more familiar objects like chairs and snooker balls. In this case further questions need to be asked about what an object is, and when we should say that a single object is involved rather than many. In the third case the bias is similarly one to do with identity: why can an object that is annihilated and recreated be more plausibly regarded as one object than an object with spatially separate parts (e.g. as a billiard ball on one side of the table, and as a similar ball on the other side, but nowhere in between)?

The above discussion, I think, shows that a great deal of care needs to be taken when exploring differences between space and time. Two very plausible examples have been considered in this section; but both have been found to be doubtful once the claims have been made fully clear.

(iv) Spatial Analogies of Passage

Curiously enough, many claims that on the surface seem to be about the passage of time actually have true spatial analogies, so long as the claims are made fully clear along the lines of the section (vii). I do not of course mean that space passes or flow in some metaphysical sense similar to that explored in the case of time in the first four chapters of this thesis. But various temporal claims which on the surface seem to be talking about passage

have quite innocuous tenseless readings and trivial spatial analogues. Again examples will make this clear. Consider the following temporal claim (see Garson [1] "Here and Now"):

> Every event later than the present will become present and every event earlier than the present did become present[6]

Assuming that any passage-type metaphysics implicit in this claim have to be rejected, the following tenseless reading can be given:

> Every event at a time later than now is "now" at a time later than now and every event at a time earlier than now is "now" at a time earlier than now.

This claim has a clear and obviously true spatial analogy:

> Every event at a place to the left of here is "here" at a place to the left of here and every event at a place to the right of here is "here" at a place to the right of here.

Another passage-related claim is also discussed by Garson. Although I can choose which place my use of "here" in ten seconds will refer to (by going to that place and saying "here" when the ten seconds are up) I cannot choose which time my use of "now" in ten seconds will refer to (it can only be the time ten seconds from now). This disanalogy seems to be related to the inexorable progress of passage - where we will be in time in ten seconds is not a matter we have any choice over. But the disanalogy is misleading because of the use in both cases of the temporal concept "in ten seconds". If this is replaced by a spatial concept e.g. "ten metres to the left" then I will equally have no choice about my use of "here". The temporal claim and spatial analogy will be:

> Temporal Claim: I have no choice about what time my use of "now" in ten seconds will refer to
>
> Spatial Analogy: I have no choice about what place my use of "here" ten metres to the left will refer to

The spatial analogy clearly holds: if I say "here" ten metres to the left there is one and only one place my use of "here" can refer to (i.e. the place ten metres to the left). Note also that in a different sense I *do* have choice about what time my use of "now" will refer to. This can be seen by looking at the following *spatial* claim, and the corresponding *temporal* analogy:

> Spatial Claim: I can choose what place my use of "here" refers to ten seconds from now
>
> Temporal Analogy: I can choose what time my use of "now" refers to ten metres to the left of here

I can fulfil the criteria of this temporal analogy simply by deciding what time I wish my use of "now" to refer to when I am ten metres to the left of here. At the appropriate time I can then go to the place ten metres to the left of here and say "now".

(v) Temporal Change and Spatial Variation

So far the suggested differences between time and space have vanished (or at least faded) under careful consideration. In this section I will look at a more likely difference. Variation across time (e.g. a door being red, then green) is regarded as being genuine change, unlike mere variation across space (e.g. the top of the door being red, but the bottom green).

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[6] It might be recalled from Chapter Three that it is arguable that this kind of statement commits what Lowe called the *indexical fallacy*. But in order to show that passage-type statements about time have spatial analogies, I assume here that the sorts of statements are allowable.

Taylor does not regard even this as being a genuine difference. He suggests that if a wire running between two towns were red near town A but green near town B, we would naturally say that the colour of the wire had *changed* somewhere in between the two towns. This is true and there are many similar examples: the surface of a table may be said to *change* from rough to smooth between one end and the other; the sea level of the land *changes* as one moves about, climbs, descends, etc. But it still might be felt that these are not proper changes. Someone might argue that we are tempted to talk of them as changes partly because there is indeed a variation (albeit across space); partly because there would be a genuine temporal change in the *experiences* of anyone walking along the red/green wire, or running their hand over the rough/smooth table.

Granted that there is a significant difference between spatial and temporal change, what is the basis of this difference? One answer I have already outlined would cause difficulties for tenseless time i.e. the claim that the difference is due to *passage*.

Is passage the only way temporal and spatial variation can be distinguished? Consider two simple examples: a wire like Taylor's that varies from red to amber to green along its length; and the variation that occurs when a traffic light turns from red to amber to green. Following Le Poidevin the key difference can be seen as due to the existence of a causal chain between the red traffic light and the green traffic light. Various causal processes to do with electronics go on inside the traffic light to ensure that after the red light is turned off, the amber light flashes and the green light comes on. These causal connections are precisely what are absent in the spatial case: the redness of one part of the wire does not cause (or stand in a causal chain) with the greenness of another part. Le Poidevin tries to give a detailed account of change; his final version has two main criteria. One part lays down conditions that cover both spatial and temporal change. Roughly[7] we can say that if two different parts O_1 and O_2 of the same object O have incompatible properties F and G, then there has been some sort of variation. The two parts O_1 and O_2 could be either spatial or temporal parts of O; the variation involved could therefore be either spatial or temporal. To distinguish between these two possibilities another criterion is needed, which Le Poidevin claims is causal in nature:

> O_1's being F and O_2's being G are causally connected via a change c_1 .... c_x, where c_1 is a constituent of O_1's being F and c_x is a constituent of O_2's being G, and such that, for each n (where n > 1), c_n is causally dependent upon c_{n-1} ... (see Le Poidevin [2], p.124-125)

The idea is roughly that there must be a causal chain linking F and G. Since causation is a temporal phenomenon rather than a spatial one, this criterion serves to distinguish genuine temporal change from spatial variation.

The correct analysis of change is a large topic and there may be plenty to discuss about Le Poidevin's account. However, my aim at this point is only to indicate that there are ways to distinguish temporal change from variation across space that do not need to appeal to passage.

(vi) The Direction of Time

Another apparently genuine difference between time and space is to do with direction. For example, I can deliberate about what to do at later times but not earlier times; whereas it is not the case that I can deliberate only about what is to the left of me, but not about what is to the right. There are a cluster of similar examples. I can affect what happens at later times, but not at earlier times; I can have more knowledge of earlier times than of later times; but neither what I can affect nor what I can know is similarly structured in terms of left and right, or north and south. The common core to these examples is that time is said to have a *direction* whereas space does not.

It might be argued that the only explanation for this "direction" difference between time and space is based on passage. If there is a difference between my knowledge of

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[7] The final version is more subtle than this, using various devices to exclude Cambridge-type changes, etc.

earlier and later times, and my knowledge of places to the left and right, this might be felt to have its roots in a passage ontology. Later times are not yet real and so cannot be known; whereas earlier times are real (or at least were briefly real) and can be known. But places to the left and places to the right are equally real. The "knowledge" difference between time and space could be explained, then, in terms of a difference between the passage-related ontology of time and non-passage ontology of space.

This is an important question. It is discussed at length in Chapters Eight and Nine, so I will not discuss it further here.

(vii) Dimensionality and Relativity

Two other differences between time and space are worth mentioning. The first is related to the idea that time is one-dimensional but space is three-dimensional. Consider the following temporal claim:

> Temporal Claim: For all non-simultaneous events x and y, either x is earlier than y or y is earlier than x

The corresponding spatial analogy is:

> Spatial Analogy: For all non-coincident events x and y, either x is to the left of y or y is to the left of x

But this analogy is not true, because of the extra dimensions that space has. Since time is like a line, any two events on that line have to be related by the ordering relation "earlier than". But in space two events needn't be constricted to a line running from left to right: they might separated instead along a line running from front to back, or from up to down. See figure 4.

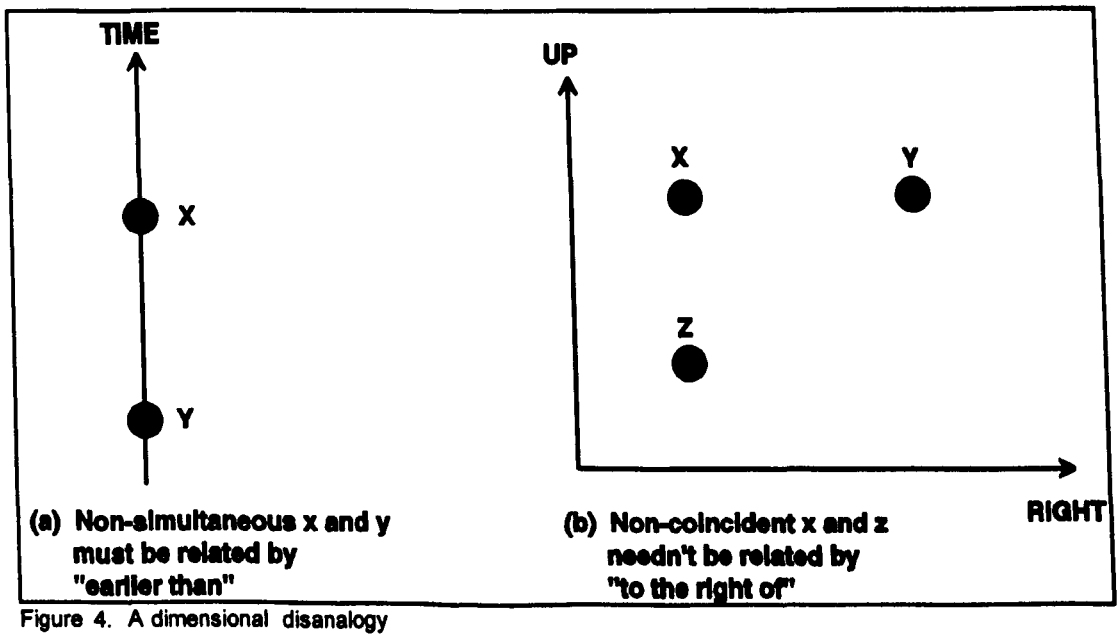

Figure 4. A dimensional disanalogy

The other difference is to be found in Special Relativity (perhaps surprisingly since relativity is often charged with treating time like space). Suppose that the universe is a four-dimensional block, with time being the fourth dimension and essentially similar to the other three. If this were so, then the equation that allows us to work out the distance I between two different spacetime points would be:

$$I^2 = x^2 + y^2 + z^2 + t^2$$

But the correct equation differs from this in two striking ways. Firstly the time coordinate is multiplied by the square of the velocity of light. The expression "c^2t^2" has the right sort of units to be added to the square of the spatial coordinates. The amount of time could not otherwise be added to the amount of space: seconds cannot be added to centimetres; hours cannot be added to miles. Multiplying by the velocity of light ensures that the time units cancels out. The expression "c^2t^2" is measured in spatial units only.

Secondly, and most importantly in the current context, the distance between the two points in the time dimension is not added at all: *it is subtracted*. Thus the correct equation is in fact:

$$I^2 = x^2 + y^2 + z^2 - c^2t^2$$

Curiously enough this difference is often covered up by replacing t^2 with w^2, where w^2 is t^2 multiplied by the imaginary number i (the square root of -1). This has the effect of turning the negative sign into a positive sign:

$$I^2 = x^2 + y^2 + z^2 + w^2$$

This manoeuvre makes the equation appear similar to what it would be in the block universe, but has the effect of making distances in the time dimension imaginary. This is despite the fact that in reality clocks never read i-1 minutes! As Wheeler writes:

> It is right to say that time and space are inseparable parts of a larger unity. It is wrong to say that time is identical in quality with space ... There is a *minus* sign ... that no sleight of hand can ever conjure away. *This minus sign marks the difference in character between space and time.* It does not really remove this minus sign to introduce ... [imaginary numbers] ... (Wheeler [1], p.37)

What is the significance of this minus sign? Why is time coordinate subtracted instead of added? The reason is connected with the distinctive geometry of spacetime in Special Relativity, which is unlike a block universe of four space-type dimensions. Defining the interval I as above has the following consequences. Firstly when the time separation (i.e.

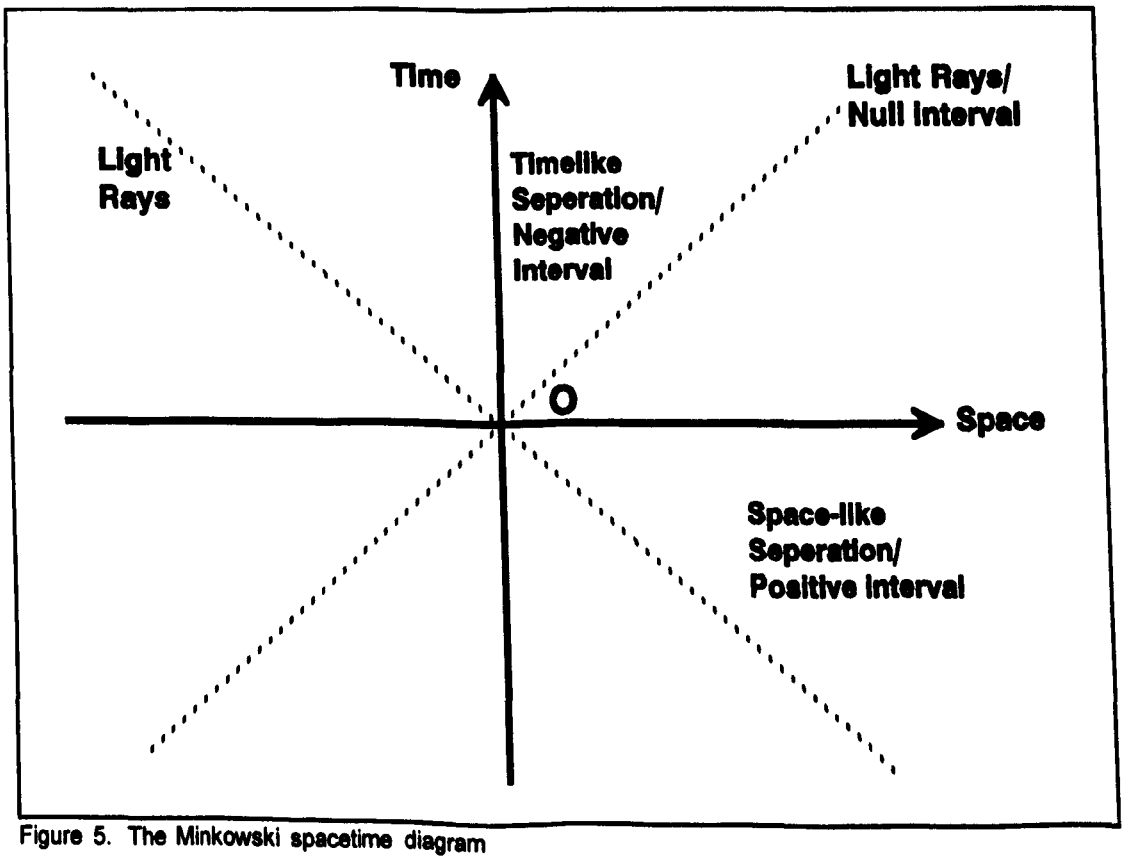

Figure 5. The Minkowski spacetime diagram

the square of the interval of time multiplied by the square of the velocity of light) is equal to the separation in space the interval will be zero - this only happens along the path of light rays. In the Minkowski diagram (see figure 5) spacetime points/locations at a zero or null interval from O lie on the paths of light rays leaving O. When the time separation of an event from O is greater than (dominates over) the spatial separation the interval is negative, indicating that the event is at a timelike separation from O (i.e. connectable with O by light and other causal signals). When the time separation is less than the spatial separation, the interval is positive, so the event is at a spacelike separation from O, unconnectible by light or any other signal. The significance of the minus sign is then as follows: defining the interval in this way ensures facts about causal connectibility between events and the finite speed of light are built-in to the geometry of spacetime: events in the timelike interval of the Minkowski diagram are causally connectible to O; events at a null interval are connectible with O only by light rays; events at a spacelike separation are not causally connectible at all. More succinctly, the (rough) significance of the minus sign is that events separated in a non-relative way[8] from each other in time can be causally connected by light and other (slower) causal signals.

(viii) Conclusions

What conclusions can be drawn from the above discussion about space-like time? I have looked at various examples which on the surface suggested differences between time and space. Of these, several turned out to not to be differences at all (or at least to need further argument before they could be accepted as differences). Time, it appears, is more similar to space than is usually thought. But on the other hand there are some real differences: genuine change only takes place in time; only time has a "direction"; time is one-dimensional whereas space is three-dimensional; and finally time is treated differently to space in Special Relativity, relating to the facts that things in time are connectible by causal signals but things in space are not.in many ways.

I have argued that tenseless time is not committed to holding that time and space are exactly alike, only that they are alike in not flowing or passing. The only potential problem is if any real differences turn out to depend on passage. But of the four genuine differences discovered none of them cannot be explained if time is tenseless. The one-dimensional nature of time and the minus sign of relativity seem to have no reliance at all on passage. The distinction between temporal change and spatial variation might arguably be connected to passage, but a tenseless alternative has been sketched. Lastly, a "direction" of time, as shown in Chapters Eight and Nine can be given a wholly tenseless explanation. The conclusion then is that none of these differences between time and space cause any difficulty for the tenseless view of time.

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[8] That is, at a timelike separation, so that there is no frame of reference with respect to which they are simultaneous with O.

Appendix C

The Presence of Experience

Everything we experience has a certain "presentness" or "nowness". This is clear in the case of seeing the sun come up, or hearing the birds sing, or thinking about a philosophical problem: the seeing, hearing and thinking are all experienced, while they are going on, as going on *now*. But the same also applies to such things as memories and expectations. A memory, for instance, may be *about* the past, but the actual act of remembering goes on (and is experienced as going on) in the present. This "presentness" seems to be a fundamental fact about our experience. But how can this experience be explained if it is not the case that the experiences are not uniquely dignified with the genuine property of being-present?

There is a distinction to be drawn between the metaphysical property of being-present, and the phenomenological quality of presence that all our experiences have. The fact that the experience of an event has the quality of presence does not entail that the event experienced is present in a metaphysical sense. A simple example (see Mellor [1], Chapter 3) should make this clear. When I look up at the night sky the events I see there in fact took place millions of years ago. This is because light from these distant stars and galaxies needs a long span of time to reach the Earth. But the "presentness" of my experience when I look at the night sky is no different to when I look out of a nearby window. In the first case the events I see are really far in the past, in the second case they are nearly contemporary with my experience. Both experiences are "present" for me; and in neither case do I have any direct perception of whether the experienced events are happening now, or a hundred years ago, or a million years ago.

The second point is that there are spatial and personal analogies to the presentness of experience. This is clearest in the personal case. Consider the following quote from William James:

> In this room - this lecture-room, say - there are a multitude of thoughts, yours and mine ... My thought belongs with my other thoughts, and your thought with your other thoughts ... The only states of consciousness that we naturally deal with are found in personal consciousnesses, minds, selves, concrete particular I's and you's. (James, p.226)

This quote reveals what might be called the *I-ness* of experience. All my experiences are experienced by me as *belonging to me, to my self or my consciousness*. In a slightly less well-defined way all my experience is also characterized by *here-ness*, in the sense that *here* is a special place for me, the centre point of the whole universe vis-à-vis my experience. These analogies suggest that the presentness of experience is unlikely to have any metaphysical implications regarding tense or passage. If experience is characterized as much by *I-ness* and *here-ness* as by *now-ness* then either a passage-free or tense-free explanation can be found; or (if not) these phenomenon support personal and spatial passage just as much as temporal passage.

Some insight can be had into the *presence* of experience by looking at the peculiar logical character of a judgement like "I am *now* in pain". Here we are interested not so much in my judgement of being in pain, but in the *tensed part of the claim*, viz. that I am in pain *now*. Mellor points out that we must distinguish between two separate things: *my actual experience of being in pain* and *my judgement that I am now in pain* i.e. in pain *at this very moment*. Granted this, what are the (tenseless) truth-conditions for my judgement that I am *now* in pain to be true. If I make my judgement at time t, then the judgement is true if and only if I am in pain at time t. It follows that if at any time t it is (tenselessly) the case that I have the experience of being in pain, my judgement made at that time to the effect that the experience is *now* cannot possibly be false.

More generally, suppose that at time t I am (tenselessly) having an experience E. A judgement made at that time to the effect that experience E is present or now must be true,

since E and the judgement (tenselessly) occur at the same time. I do not mean of course that the judgement that I am now having experience E could under no circumstances be false - it would be false if made at a time when I was not having experience E[9]. But whenever it is (tenselessly) the case that I am having experience E it will always be true to judge that I am *now* having experience E. In other words, in the case of *all* the experiences I have had and will have it will be true to judge (at the time that the experiences occur) that they occur *now*.[10]

The point is that judgements to the effect that I am *now* having a particular experience will be *trivially true* in all cases in which the judgements are made while I am having that experience.

While Mellor's explanation appears to contain some truth, I think a fuller explanation can be given using some of the ideas presented near the end of Chapter Five viz. Recanati's psychological modes of presentation. For Recanati, when we entertain a proposition, it may be dressed up in a particular way: more precisely, it will appear under a psychological mode of presentation such as Ego, Hic or Nunc. These three modes of presentation let us know that the proposition is about ourselves (Ego) and that is about what is going on here (Hic) and now (Nunc).

In terms of Recanati's ideas, why do my perceptions, thoughts, memories, desires and so on, have the quality of presence? One reason is that propositions play a large part in all these activities, and these propositions will appear under the mode of presentation Nunc. When I see a table, I acquire a belief in the proposition *that there is a table in front of me*. This proposition is presented to me under Nunc i.e. as occurring now. Similarly, when I want something to eat, I have a desire to make it the case *that Duncan Cryle has something to eat at 6 p.m.*, where this proposition is presented in terms of both Ego and Nunc (*I* want to eat *now*). In the case of memory, I will be aware of what is going on in my mind i.e. *that I am remembering the time when I walked up Snowdon*. Again, this proposition is presented in terms of Nunc[11].

The advantage of looking at this question in Recanati's way is that an explanation can also be given for the presence of "raw" perception and experience. When I look at a table I need not conceptualise my experience to the degree of gaining the belief *that there is a table in front of me*. I might just be looking, not taking in what I am looking it, or thinking anything much at all. This level of raw experience is out of the domain of Nunc, since no propositions are involved; yet the experience still has presence.

The reason why raw experience still has presence can be seen by recalling the origin of the more conceptual Nunc. Roughly, Recanati links Nunc to *a particular way of gaining information*:

> Egocentric concepts are distinguished by their specific function: they are used to register information *gained in a certain way* (Recanati [1], p.88)

The concept of Ego, for instance, is linked to information that can be gained about a particular person *in virtue of being that very person*. It is knowledge I have of myself "from the inside". In the case of Nunc, the information is gained in a way linked specifically to a person's location in time. It is the information a person can have about what is going on at that time *in virtue of being at that very time*.

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[9] Although I would be unlikely make wrong judgements of this sort. Is it possible to someone to misjudge, for instance, that they were in pain? Note however that this is not the same question to the one being considered: one is to do with whether I can be mistaken about the contents of my experience; the other is to do with whether, when I have an experience, I can make a mistake it judging myself to be having it now.

[10] Similar points apply for *I-ness* and *here-ness*. In the case of *I-ness*, for instance, If I am in pain and if I judge that *I myself* am in pain, my judgement cannot possibly be false. This is because the judgement that it is *me* who is in pain, made by me myself, will be true if and only if I am in pain.

[11] The proposition is *that I am remembering the time I walked up Snowdon*, which is entirely different from the proposition *that I walked up Snowdon*. Only the first proposition is presented under the mode of presentation Nunc. In other words, it is the memory of the walk that is present, not the walk itself.

Below the level of egocentric concepts, Recanati talks of the information being stored in *perceptual buffers*. These buffers are open to all the information that floods through our senses; the information is not yet sifted and conceptualised. The point is that these buffers are still linked to a specific ways of gaining information: the way of gaining information about a person in virtue of being that person, the way of gaining information about a place in virtue of being in that place, and the way of gaining information about a time in virtue of being at that location in time. Because of this, even at this raw level, experience is structured in terms of I, here and now. In particular, experience will still be distinguished by the quality of presence.

This explanation seems plausible. The important point in the present context is that no mention is made of the metaphysical property of being-present. There is no need (or use) in invoking this property in order to explain the presence of our experience.

Bibliography

Henri Bergson [1]. An Introduction to Metaphysics. 1913.

John Bigelow [1]. Worlds Enough For Time. Nous 25 (1991), pp.1-19

F.H.Bradley [1]. The Principles of Logic. 1922

C.D.Broad [1]. Scientific Thought. 1952.

J.Butterfield [1]. Seeing the present. Mind 1984 Vol XCIII, pp.161-176.

F.M.Christensen [1]. Space-like time. 1993.

Paul Davies [1]. Time Asymmetry and Quantum Mechanics. In Flood and Lockwood ed. "The Nature of Time", 1986.

Michael Dummett [1]. Bringing About the Past. In Gale [1].

John Earman [1]. An attempt to add a little direction to the problem of the direction of time. Philosophy of Science 41 (March 1974) pp.15-47.

Gareth Evans [1]. Understanding demonstratives. In Yourgrau [1].

John Foster [1]. The case for idealism, chapter 16. 1982.

Richard Gale [1]. The Philosophy of Time ed. 1968.

Richard Gale [2]. The Language of Time. 1968.

Richard Gale [3]. "Here" and "now". In Freeman and Sellars, ed. "Basic issues in the philosophy of time", 1971.

James Garson [1]. Here and Now. In Freeman and Sellars, ed. "Basic issues in the philosophy of time", 1971.

P.T.Geach [1]. Some Problems About Time. In Studies in Philosophy of Thought and Action ed. Strawson. 1968.

Paul Horwich [1]. Asymmetries in Time. 1987.

David Hume [1]. Enquiries Concerning Human Understanding. Oxford 1992 (Nedditch).

William James [1]. Principles of Psychology. 1950.

David Kaplan [1]. The Logic of Demonstratives. In Journal of Philosophical Logic 8 (1978), pp.81-98.

David Lewis [1]. Counterfactuals and Time's Arrow. In Nous 13, 1979, pp.455-475.

Michael Lockwood [1]. Mind, Brain and Quantum. 1989.

E.J.Lowe [1]. The Indexical Fallacy in McTaggart's Proof of the Unreality of Time. In Mind 96, 1, pp.62-70.

E.J.Lowe [2]. McTaggart's Paradox Revisited. Mind 101, April 1992.

Storrs McCall [1]. Objective Time Flow. Philosophy of Science 43, 1976, pp.337-362.

Storrs McCall [2]. A Dynamic Model of Temporal Becoming. Analysis 1984 pp.172-176.

Storrs McCall [3]. A Model of the Universe. 1994.

J.M.E.McTaggart [1]. The Unreality of Time. In Gale [1].

J.D.Mabbot [1]. Our Direct Experience of Time. In Gale [1].

J.L.Mackie [1]. The Cement of the Universe. 1974.

Ned Markosian [1]. On Language and the Passage of Time. Philosophical Studies 66, 1992, pp.1-26.

Jack W.Meiland [1]. A Two-Dimensional Passage Model of Time for Time Travel. Philosophical Studies 26 (1974) pp.153-173.

D.H.Mellor [1]. Real Time. 1981.

Izchak Miller [1]. Husserl, Perception, and Temporal Awareness. 1984.

David Owens [1]. Causes and Coincidences. 1992

John Perry [1]. The Problem of the Essential Indexical. Nous 13, 1979.

John Perry [2]. Frege on Demonstratives. In Yourgrau [1].

Robin Le Poidevin [1] and Murray MacBeath. The Philosophy of Time, ed. 1993.

Robin Le Poidevin [2]. Change, Cause and Contradiction. 1991.

Robin Le Poidevin [3] and D.H.Mellor. Time, Change and the Indexical Fallacy. Mind 96, 4, pp.534-8.

Huw Price [1]. Time's Arrow and Archimedes' Point. 1996.

A.N.Prior [1]. Changes in Events and Changes in Things. In Le Poidevin [1].

Christopher Ray [1]. Time, Space and Philosophy. 1991.

Francois Recanati [1]. Direct Reference. 1993.

George Schlesinger [1]. E Pur Si Muove. Philosophical Quarterly 41, 1991, pp.427-41.

L.Sklar [1]. Space, Time and Spacetime. 1974.

J.J.C.Smart [1]. Philosophy and Scientific Plausibility. In Smart [4].

J.J.C.Smart [2]. Time and Becoming. In Smart [4].

J.J.C.Smart [3]. Causal Theories of Time. In Smart [4].

J.J.C.Smart [4]. Essays Metaphysical and Moral. 1987.

Quentin Smith [1]. Language and Time. 1993.

Richard Sorabji [1]. Time, Creation and the Continuum. 1983.

Ernest Sosa [1]. Propositions and Indexical Attitudes.

Ernest Sosa [2]. The Status of Becoming: what is happening now? Journal of Philosophy, 1979, pp.26-42.

Timothy Sprigge [1]. The Unreality of Time. Presidential Address of Proceedings of the Aristotelian Society. 1992.

Euan Squires. Mysteries of The Quantum World.

Richard Swinburne [1]. Tensed Facts. American Philosophical Quarterly, Vol 27, No.2, April 1990.

Richard Taylor [1]. Spatial and Temporal Analogies and the concept of identity. Journal of Philosophy 52, October, pp.599-612.

Richard Taylor [2]. Metaphysics. 1992.

Bas Van Fraassen [1]. An Introduction to the Philosophy of Time and Space. 1985.

H.G.Wells [1]. The Time Machine. 1971.

J.A.Wheeler and E.F.Taylor. Spacetime physics. 1966.

G.J.Whitrow [1]. The Natural Philosophy of Time. 1980.

Donald Williams [1]. The Myth of Passage. In Gale [1].

Palle Yourgrau [1]. Demonstratives. 1990.

David Zeilicovici [1]. A (Dis)solution of McTaggart's Paradox. Ratio XXVIII, 2, December 1986, pp.175-195.

David Zeilicovici [2]. Temporal Becoming Minus the Moving-Now. Nous 23 (1989) pp.505-524.