Time and Subjective Facts:

Readings in *From Brain to Cosmos*

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Abstract

This document consists primarily of excerpts (chapters 5 and 7-9) from the author's book *From Brain to Cosmos*. These excerpts address some traditional philosophical problems about temporal flux and identity through time, using the concept of subjective fact that the author developed earlier in the book. (Readers unfamiliar with that concept are strongly advised to read chapters 2 and 3 of *From Brain to Cosmos* first. See the last page of this document for details on how to obtain those chapters.)

For more information about the author's book *From Brain to Cosmos*, or to learn where to find other chapters of the book, please consult the last page of this document.

Chapter 5

Conscious Beings and Their Histories

In Chapter 4 I showed how to take a preliminary step toward the first goal set forth in Chapter 1. To do that, I pointed out a logical fact about consciousness events: that one consciousness event can exist for another. This fact is interesting, not only because of its consequences for knowledge, but because of its bearing on another major philosophical problem: that of *personal identity.* In this chapter I will show how the ideas of subjective fact and of consciousness events can lead us toward a solution to this problem.

Personal Identity: An Introduction

The problem of personal identity[1] is one of the most important philosophical problems from a practical point of view. It amounts to the following question: How do all the different stages and events in a person's life form the life of a single, undivided individual? It is not obvious why these

events and stages don't just exist as separate phases, instead of amounting to the career of one person. If we look at a single snapshot from a person's life — a single moment or brief stage — it may be clear that there is one person there. But if we consider two such stages, perhaps many years apart, what are the grounds for claiming that they really are phases in the career of the same person?

The problem of personal identity becomes acute when we consider that some people change a lot over time, and that all of us change at least a little from moment to moment. The problem asks us to consider what, if anything, remains the same through all these changes.

The philosophical literature contains several different accounts of personal identity. Such accounts examine the conditions under which two given states or stages of personal existence are parts of the career of the same person. I will not attempt here to summarize all of these theories or to criticize them individually. Instead I will refer the reader to the literature on this topic for further information.

Different people have different intuitive views about what must happen if they are to continue existing through time. For example, many people feel that the persistence of memory is necessary for personal survival. On this view, a case of total, irreversible amnesia, followed by relearning of all the facts and skills that one person might know, would lead to the creation of a new person.[2]

Many philosophers have argued that the continuity of memory, or at least of memory-like mental traces ("quasi-memory"), is necessary for personal identity through time.[3]

But some people feel that even if they suddenly lost their memories and had to put everything back together from scratch, they still would survive in some form, provided that the "stream of consciousness" (William James' phrase)[4] containing their experiences is not irreversibly interrupted.[5] Some philosophers, notably James[6] and more recently John Foster[7], have supported views of personal identity in which the continuity of a stream of consciousness plays a central role. Such views differ substantially from those which require continuity of memory. One can think of puzzle cases (usually involving complete forgetting of everything, what Sydney Shoemaker has termed "philosophical amnesia"[8]) in which continuity of consciousness is preserved although continuity of memory is lost. Theories of personal identity also differ from one another in other ways far subtler than the ones I have described here.

Differences among views of personal identity have practical implications, some of them deadly serious. The most dramatic examples of these implications arise in medical ethics. Here I will mention only one such example, based on ones in the literature.[9] Imagine that a patient has contracted a brain disorder which leads to complete amnesia but not to coma, and which leaves no permanent physiological impairment so that the patient can relearn everything from scratch and thereafter live a nearly normal life. If personal identity depends upon continuity of memory, then the original patient has ceased to exist. Thus, killing the patient immediately after the onset of total

amnesia merely prevents the formation of a new person. Such an act seems at first glance to have roughly the same moral import as contraception; it prevents the creation of an as-yet-nonexistent person. But if personal identity depends upon some version of continuity of consciousness, then the same person likely still exists after amnesia sets in. In that case the killing is a much more serious matter; it is euthanasia at best, murder at worst.

The differences between theories of personal identity sometimes are thought to have important consequences for beliefs about immortality.[10] Suppose that you somehow got the straight information on what will happen to you after your death. Suppose that what you learned was that the perceptual processes now occurring with the help of your brain will either continue somehow in an immaterial soul or be transferred by scientists to the brain of a new body. However, all of your memories (along with "quasi-memories" and the like) of life on Earth will perish with your cortex. Would this form of "immortality" constitute your survival?[11] On the continuity-of-consciousness view of personal identity, this scenario may yield real survival — a continuation of your existence, albeit one in which you start all over again as what psychologists call a "blank tablet." On memory-based views of identity, this scenario leaves no hope of survival.

An Agenda

In this chapter I will develop a partial theory of the histories of conscious beings. I will not yet try to pass from facts about how things seem to the conclusion that there are conscious beings which persist through time. (I will address that task in Chapter 10.) But one does not need to assume that there are persisting conscious beings to study those interesting trains of events which we call "histories of conscious beings." For now, one can think of these trains simply as histories of *changing points of view*. Alternatively, one can think of them as *conscious lives* — temporally extended processes involving awareness.

The theory developed here will make use of the apparatus of consciousness events and subjective fact developed in previous chapters. My aim in developing this theory is twofold. First, I want to pave a little more of the road from experience to cosmos by showing that one can infer the existence of a conscious-subject history from facts about how things seem now. Second, I wish to clarify and rigorize some concepts which we often use informally and which will be used more carefully in later chapters of the book. The most important of these concepts is that of *subjective time* — time as experienced by a conscious subject.[12]

Before beginning, I want to examine a more general problem about the notion of personal identity.

The Vagueness of Personal Identity

Philosophers have noticed that the notion of personal identity may be vague in a significant way. Shoemaker has pointed this out explicitly[13], and also has referred to "a parochial element"[14] present in our usual thinking about that identity. Eli Hirsch has discussed the possibility of alternative notions of personal identity which might appear as normal to some (possible) beings as our notion does to us.[15] The arguments with which these various philosophers support their various conclusions suggest that there is no unique, logically rigorous notion of personal identity, and that our ordinary criteria of personal identity may well contain a conventional (or at least a contingent) element. The differences among different notions of personal identity do make a difference; they can lead to distinct moral and religious conclusions. Hence we must *explicate*, or find a more precise version of, the notion of personal identity before we can hope to compare these alternative conclusions.

My objective here is to define and study one precisification of the notion of personal identity. I will provide a definition of a rigorous notion — that of the identity of a *conscious subject* through time — which corresponds roughly to the notion of the identity of a person. Foster already has proposed an interesting account of the identity of the conscious subject — what he has called "subject identity."[16] My account will be similar to Foster's

in certain respects, though the two accounts differ in important ways.[17] My account of conscious-subject identity is not supposed to capture the entire intuitive notion of personal identity, nor will it agree perfectly with everyone's feelings about personal continuity. (For example, I doubt that every person would feel comforted if it turned out that something identical to him/her in the suggested sense will continue to exist after his/her death — although I think that he/she should feel somewhat relieved.) The notion of the identity of the conscious subject does come close enough to the idea of personal identity to count as one plausible way of making the latter notion precise.

Continuance and Subjective Duration

In what follows I will use the term *conscious subject*, or just *subject*, informally to mean "conscious being." At this stage, I am not yet using the existence of conscious beings as a premise. However, it will be convenient to talk about subjects to motivate certain arguments. Without defining "subject" at this stage, I will take it for granted that a subject is an entity whose history includes consciousness events. This, I believe, would follow if one defined a conscious subject as an entity which is conscious. The most familiar conscious subjects are conscious humans — or, if one prefers, their conscious minds or selves. In Chapter 10 I will take up the topic of conscious subjects again, and will provide a more rigorous characterization of conscious

subjects.

Our immediate aim here is to find out in what the identity through time of a subject's consciousness consists. First we need to find an answer to the following question: Under what conditions do two consciousness events form parts of the same conscious-subject history? This is the analogue, for conscious subjects, of the question of the nature of personal identity.

We can restate the question of conscious subject identity as follows. Consider two consciousness events; call them x and y. What determines whether x and y are consciousness events in the same conscious life, or subject history? In other words, how are the consciousness events in the life of a conscious being strung together to form the conscious life of a single being?

In Chapter 4 I discussed the fact that one consciousness event can exist for another. If a consciousness event y exists for another consciousness event x, then in x it seems as if y exists. However, in x, it may be that y does not seem *present*, but seems just past; it may be the case (and normally always is the case) that y is not the same consciousness event as x. In x, it may seem as though y just occurred; although y seems to be past, some of the subjective content of y "carries over" into x as part of the realm of subjective fact associated with x. From now on I will use the word *continuance* to describe this relationship between two consciousness events. That is, if x and y are consciousness events and y exists for x, I will say that y undergoes *continuance* in x, or simply that y is *continued*

during, or in, x.

The next few paragraphs are intended to point out and emphasize some psychological features of continuance. In this paragraph I will speak freely of subjects, experiences, and the like. By doing this, I am not introducing the existence of such entities as a premise. Rather, I am using discourse about such entities to point out certain facts about the way things seem.

Continuance does not occur only during episodes of deliberately focused attention, like those which arise when one works through the examples (1)-(4) in Chapter 4. Continuance occurs all the time during ordinary experience. Normally you do not think about this phenomenon. Yet every moment that you are having experiences, you also experience the fading away of immediately past experiences. For example, continuance occurs when I turn my eyes in the customary way and look at different things. As each new view begins, I "feel," without thinking about it, that what I am looking at has changed. The previous view is no longer seen, but the fact that there was such a view is evident a very brief time after that view ends. A short while later, the previous view fades into memory, or (more often) simply is forgotten.

Immediately after hearing a sudden loud noise, you are aware that something has taken place. The noise still is a matter of "immediate" experience; it has not yet become a mere memory. During the moment immediately after you hear the noise, you are no longer hearing the noise. Nevertheless, you are *immediately, directly* aware that it

happened; the event of its happening still exists for you. At that moment, continuance is occurring. The instance of seeming in which you heard the noise exists for your consciousness, but the noise no longer is heard.

Continuance allows one to be aware that one has just had an experience. Also, it allows one to know this with certainty. These points were made in Chapter 4, where I argued, in effect, that a certain kind of knowledge about consciousness events in continuance is infallible in a limited way. Memory does not share this virtue with continuance. If continuance of a remembered experience is absent, one cannot be absolutely certain, on the grounds of present experience alone, that one has had that remembered experience. There always is the threat of a false memory. But with continuance, such a threat is not an issue. When a consciousness event of yours undergoes continuance, the consciousness event itself exists for you after it ceases to belong to your present experience. The continued experience could not have been pure fantasy, or something implanted in your mind through neurostimulation, as a remembered experience might have been. (If the experience of a continued consciousness event were somehow implanted, then that consciousness event would have to have been implanted also!)

The above remarks reveal a logical connection between continuance and our *awareness of time.* In ordinary human experience, the continuance of a consciousness event makes that event seem to be immediately past, or at least passing. If a consciousness event besides a present one is not being

continued now, then that consciousness event does not appear to be in the immediate past; it may seem to be remembered from the more distant past, or perhaps it does not seem to have happened at all. Hence what is immediately past *for me* — that is, in the time ordering of my experiences as they happen to me — is simply what I am experiencing in continuance.

It is important to recognize that this kind of *psychological* immediate pastness is not the same as immediate pastness in *physical* (clock) time. The difference between these two relations becomes more obvious in cases of anesthesia or very deep sleep. It is my understanding that persons undergoing surgery under general anesthesia sometimes wake up with the feeling that no time has passed since they became unconscious, and that the happenings immediately preceding unconsciousness have "just happened." A similar experience occasionally happens in connection with normal sleep. If an experience of this sort happens, then some final moment of experience, which occurs just before the onset of unconsciousness, must lie in the immediate subjective past of the first consciousness event after awakening. For the subject, nothing has happened in between, although for outside observers time has passed. (Often the subject does not remember the last moments before unconsciousness, but this possibility need not affect the validity of this argument.)

Another example of the difference between subjective and physical pastness comes from certain psychological experiments in which events are perceived to be in the wrong temporal order. Under certain conditions, stimuli

may seem to be in an order different from the order in which the stimuli actually occurred, or it may appear as though later sensations somehow influenced the perception of earlier ones.[18] This suggests that stimuli occurring in a certain order in time may give rise to experiences which occur in the opposite order in the ordering of subjective time provided by continuance. (Of course, there are other possible interpretations of these experiments. Perhaps the experiences occur in the same order as the stimuli, but afterwards *seem* to have occurred in reverse order. This interpretation actually may agree with our first interpretation, especially if Dennett's conception of what happens in these experiments is at least partially correct. On his view, it normally is impossible to say whether the experiences only are recalled as if they occurred initially in the wrong order, or whether they really occurred in that order.[19])

The Stream of Consciousness

A history of a conscious subject can be thought of as the history of a single consciousness as it persists through time. This way of thinking about subject histories is not new; it can be found in Locke's theory of personal identity[20] and more recently in Foster's theory.[21] Using the language of Chapters 2 and 3, we can say that such a history is some sort of series of successive consciousness events, with one event giving way to another. A string of consciousness events of

this sort, with each event giving way to the next, is the only item which can be said to be a process of being conscious — that is, to be the history of an ongoing consciousness.

This view of the history of a conscious subject allows us to form a clearer picture of what holds such histories together. If one consciousness event comes just before another, then the two events form parts of the same subject history. However, it is not important that the second event comes after the first one in "real," physical clock time. It is enough that it seems, during the second event, that the first event just happened. As we have seen, if one consciousness event is continued during a second one, then the first event is in the immediate past, or is entering the immediate past, from the subjective point of view of the second one. This continuance of one consciousness event in the next is what makes one momentary viewpoint "flow into" another to make up the successiveness of our ordinary experience. Hence if one consciousness event is in continuance during another, both events belong to the history of the same conscious subject.

Two consciousness events belong to the same subject history if they are connected by continuance in this way. We can extend this to more than two consciousness events. Suppose that there are three consciousness events a, b, and c, and that a is continued in b and b is continued in c. Since a is continued in b, a and b belong to the same subject history. Similarly, b and c belong to the same subject history. Hence all three consciousness events can be thought of as belonging to the same subject history. In general, two

consciousness events are parts of the same subject history if one can get from one event to the other by tracing a chain of consciousness events, each of which has the previous one in continuance. In such a chain, each consciousness event dies away in subjective time as the next one begins; the new event involves an immediate awareness of the previous event and of some of the content of the previous event. This intimate mingling of consciousness events constitutes the continuity of a *single consciousness* through time. Each event is a moment of experience in the life of that consciousness.

The kind of identity described in the last two paragraphs can be thought of as the identity of a *naked consciousness* through time. (One should remember that it is no more than this. I do not pretend to know whether this kind of identity is the same as personal identity for any sense of "person" richer than "conscious subject" — for example, the moral or legal understandings of a person.)

If one consciousness event "gives way" to another in the manner which I have just described, then the second event can be thought of as a continuation of the same process or "act" of being aware which began with the first event. One can find convenient examples of such continuing "acts" of awareness in one's own life. If you look at something, and then continue to look at the same thing, then the resulting prolonged experience of yours will span many new consciousness events which are connected to the first event in the way I described above. Each consciousness event within this experience (except for the last) is in the

immediate subjective past of another consciousness event within that experience. For all practical purposes, each consciousness event in such a chain embodies the same consciousness as does the previous event. A new consciousness event can comprise a different stage of each of the processes of sensing, thinking, and so forth which began during preceding events.

At each consciousness event in this chain, the relationship between that event and the one before it *seems like a change, or at least like a transition in time.* The following argument explains what I mean by this.

Consider a case in which a consciousness event (call it x) is continued in a second consciousness event, y. There is one point of view, or way things seem, associated with x. There is a different point of view associated with y. Suppose that there is a subject whose history includes x and y. Then both x and y involve pieces of the experience of that subject. However, the subject never experiences both of these instances of seeming as simply being present at once. This is because the subject has no experience of x and y *together*. There is no consciousness event z such that both x and y exist for z. There is no consciousness event z such that all the facts which seem to be the case either at x or at y, seem to be the case at z. Hence a subject cannot experience both x and y as if they were present at once. At any consciousness event, either x seems present, or y seems present, or neither one seems present — but both cannot seem present. Thus, during y, it seems as though the contents of y are there *now*, while the contents of x are not

there now but are close to "now," or are just leaving the "now," or enter somehow into the experience which seems present "now." In other words, from the viewpoint of y, the connection between x and y seems rather like a change.

This argument can be stated less formally as follows. When one sits and stares at a statue, one sees the statue in a continuing way; first one sees it, then one sees it, and sees it, and sees it, and.... Each of these viewpoints involving the statue is a little different from the others; at very least, it involves a sensation or impression or *feel* of having looked a little longer than one had looked during the previous moment. For an experience to persist — to "take up time" or to "last" — is for the experiencer to pass through various slightly different viewpoints in this way. Yet a single viewpoint, by definition, cannot involve passing through various viewpoints in this way. Hence it cannot be felt as something lasting, in the normal sense of "lasting." It does not "go on and on." It must feel as though it were "here and gone" — here during one consciousness event, gone relative to other viewpoints which come after that event in the subject's history.

Thus, when consciousness events are linked by a subject history, their contents must include kinds of experience somewhat like those one normally associates with the passage of time. If one takes "subjective time" to mean the apparent succession of consciousness events along a subject's history, then subjective time *feels like time.* (Of course, many of the features of human time perception — such as long-term memory, expectation of the future, the

sense of time's length, the feeling of inexorability, etc. — may not be common to all possible subject histories.)

The consciousness events in a subject history form what William James called a "stream of consciousness."[22] Consider a series of consciousness events connected into a subject history in the way I just described — that is, consciousness events a, b, c, d,... such that a exists for b, b exists for c, c exists for d, and so forth. The event b involves the continuance of a. Thus b is the consciousness event to which a gives way as subjective time passes. The consciousness embodied in b has the event a as part of its subjective realm, so to speak; when b seems present, a seems to die away. A similar continuation of consciousness goes on through c, d,.... Each of these events has among its subjective facts the existence of the previous consciousness event. For each consciousness event, the previous "moment" of subjective time is the consciousness event that is just ending. Hence for the consciousness at b, some subjective facts involved in a are in the immediate past. Those subjective facts belong to the fading experiences that happened in the immediate past. We can think of the consciousness in b as a stage in a process of being conscious; the event a which precedes b in the chain also is a stage in this process. It is intuitively plausible to speak this way, because b involves the experiencing as *just past* of some things which for a were *present.* In this way the events a, b, c, d,... make up a single stream of consciousness. Those events are stages in what amounts to an ongoing process of having experiences, embodied at each moment in

some particular consciousness event. Each moment of consciousness in that process "lives on" through continuance into new moments.

The relation of continuance which ties together the stream of experience also provides that stream with an *experienced temporal order*. If a consciousness event y exists for a consciousness event x, then for x, y happens "just before" x. The event x involves continuance, which is a sort of appearance of what has just passed; what has just passed is y. Thus we can say that y is *immediately subjectively past* for x if and only if y is continued during x. We can define a subjective time order relation in terms of this relation: say that y is *subjectively past* for x if and only if either y is continued during x or there is a chain of consciousness events y, a, b,...,z, x such that y is continued during a, a is continued during b,..., z is continued during x. (Actually, we only need three consciousness events to construct this chain.) This definition captures what we mean when we say that one experience occurs before another in the stream of consciousness. One cannot plausibly regard a consciousness event of a subject as being past in subjective time unless, in subjective time, it once was *immediately* past — that is, unless one can trace a chain of experience back to the event, by tracing the relation of immediate pastness. Conversely, if an event x once was immediately subjectively past (that is, if the event is followed in subjective time by an event, which is followed by an event, ..., which is followed by an event which is immediately past), then it is intuitively correct to say that x occurred in the subjective past.

This characterization of subjective pastness does not presuppose the existence of physical time or of physical temporal order. Under ordinary conditions, our experiences unroll as physical time marches forward, but these two time orders are logically distinct. Subjective time order is a felt ordering of experiences; physical time order is established with the aid of clocks or similar physical means. As we have just seen, subjective time order can be defined independently of physical time. Even if it turned out that the physical world were illusory (and I am *not* arguing that it is), there still could be subjective time for conscious beings. The search for a physical explanation for time perception is an important scientific task, but we do not need such an explanation to know that subjective time is real. Whether x is subjectively past for y depends only upon the subjective facts associated with x and with y. (Earlier I mentioned that subjective time may stop while physical time proceeds, if a person becomes unconscious.)

Using this characterization of subjective pastness, we can frame definitions of other subjective temporal notions. For example, by recognizing that a is in the subjective future of b if and only if b is in the subjective past of a, we can obtain a definition of subjective futurity in terms of continuance.

The notion of subjective time discussed above should not be confused with other psychological notions about time. It tells us nothing about phenomena like the awareness of time's apparent length or the understanding of past events.[23] These phenomena are not part of the naked successiveness of experience which I call "subjective temporal order."

An Empty Objection Defeated

One possible objection to the above picture of subject history arises from criticisms of the notion of the stream of consciousness. Dennett, in particular, has questioned this notion. On Dennett's view, the contents of consciousness result from what amounts to the ongoing "editing" of the data of experience, not from one unique, consecutive process.[24] But even if Dennett's theory were right, it could not imply that consciousness does not consist of a single stream — provided that we take "consciousness" to mean "the possession of a way things seem" (recall Chapter 2). Even if the stream of consciousness were an illusion of some sort (as Dennett's theory suggests it is), there still would be a way things seem *in the illusion* — that is, there would be subjective facts and consciousness events. Given a particular way things seem, it might sometimes seem that another consciousness event of a particular kind just happened. According to the arguments in Chapter 4, this would mean that there really was such a consciousness event. (This would be the case even if no "conscious" processes had happened in the brain before the later consciousness event. In that case, the "earlier" consciousness event could come into being at the same physical time as the "later" one, yet still be earlier in subjective time.) A chain of consciousness events linked together by this relationship would constitute a subject

history. Hence even if Dennett's "Multiple Drafts model"[25] were right, it would not have any bearing on my conclusion that there exist streams of consciousness events, and that the life of a subject consists of a stream of consciousness events.

In my opinion, the stream of consciousness which Dennett's theory criticizes is not the same as the phenomenon which I am calling a "stream of consciousness." The stream of consciousness which Dennett rejects is essentially a series of successive "'presentations'"; Dennett argues that the presentations which this would require do not really occur.[26] The stream of consciousness which I am championing is simply a stream of successive *viewpoints*, whose real nature remains open. The consciousness events in the stream need not be or involve "presentations" of the sort which Dennett rejected. Hence the "stream" presented here is not necessarily the same as the stream which Dennett has criticized. When James investigated the stream of consciousness, I think he had the stream of viewpoints in mind. Note also that the stream of consciousness events need not really be temporally continuous (that is, continuous in physical, clock time); it need only seem continuous. Hence Dennett's objection to the view that consciousness is continuous[27] is irrelevant here.

My remarks in Chapter 2 about theories of consciousness are important to remember at this point. No theory of consciousness can force us to believe that there are no consciousness events or that no subjective facts are the case.

At most, such theories can only provide us with views about what those items really are. My account of the stream of consciousness utilizes certain relationships among consciousness events, without regard to what consciousness events really are (material? immaterial? behavioral?). Hence no tenable theory about the real nature of consciousness can contradict my account. Furthermore, my account is not a theory of consciousness and does not imply such a theory. I should mention again that Dennett's theory of consciousness does not attempt to refute subjects' claims about the way things seem.[28]

Subject Identity During Periods of Unconsciousness

A subject can undergo a temporary lapse of consciousness without starting a new subject history and without any interruption of the flow of subjective time. My earlier remarks on anesthesia should make clear why this is the case. States of total unconsciousness such as deep anesthesia need not interrupt the subjective temporal succession of consciousness events. During ordinary waking consciousness, consciousness events continually transpire as physical time passes. Thus, there is a correspondence between the passage of subjective time and that of physical time. During anesthesia, subjective experience fails to flow during some interval of physical time. But prima facie, the stream of consciousness is not

interrupted; instead, the usual relationship between physical and subjective time is modified. Anesthetic states do not really break the stream of consciousness. They merely allow an unusual quantity of physical time to elapse during the transition between one temporal phase of that stream and the next. They also may prevent remembering of subjective facts from consciousness events shortly before the anesthesia.

The above remarks hold for states in which a person becomes totally unconscious — that is, undergoes no consciousness events during an interval of physical time. Most so-called unconscious states are not of this sort. Dreaming sleep is accompanied by some subjective activity and therefore is a segment of the subjective time stream, not a gap in it. Such a condition is not a genuine instance of unconsciousness; it is a condition in which the *content* of consciousness has become markedly altered. The same can be said for any other odd state of awareness in which some subjective life persists. Fugues, near-comas with some residual sensation, periods of what Leibniz called "minute perceptions,"[29] and the like do not pose any threat to the identity of the subject. (Whether such states can affect *personal* identity is a separate question.)

Three Technical Notes

In the rest of this chapter I will lay out some technical details of my theory of subject histories. The three technical

notes which follow will be of interest mainly to those with interests in logic or in the philosophy of logic; it is possible to skip these notes without loss of continuity. The first note shows how the ideas of subjective time and of subject history can be made rigorous. It also underscores the point that a conscious subject history is not a logical construction. The second note asks the question "To which ontological category does a subject history belong?" The third note examines some topological properties of subjective time, and some possibilities for unusual topologies of subjective time.

Note 1: How To Formalize Subjective Time

This note indicates how the concept of subject history might be formalized. I will point out one way in which this can be done within a second-order formalized language. (For the required logic and set theory, see texts on those subjects.[30])

Let F be a class (or, if one prefers, a property) of consciousness events. Define the *subjective precedence relation* on F as the transitive closure of the continuance relation on F. More precisely, say that a relation R is a subjective precedence relation on F if and only if the following three conditions are met: (1) F is the field of R; (2) for all x and y in F, if x is continued in y then x bears R to y; (3) R is transitive on F; and (4) R has no subrelation besides itself which satisfies (1), (2), and (3). Then define a

subject field as a class F of consciousness events with the following properties: (1) F is *nonbranching* — that is, no x in F is continued by two distinct consciousness events in F or continues two distinct consciousness events in F; (2) F is *maximal* with respect to continuance — that is, (2a) if x is in F and there is some consciousness event y which continues x, then some such y is in F, and (2b) likewise with "continues" replaced by "is continued by"; (3) F is the field of a subjective precedence relation R on F which is *connected* — that is, for any distinct x and y in F, either x bears R to y or y bears R to x. A subjective precedence relation is what we informally call a relation of subjective pastness or "beforeness." Finally, an object is a *subject history* if and only if it is the *mereological composite*[31] of all consciousness events in some subject field. In other words, the subject history is the whole of which those consciousness events are parts. The subject history is not the subject field (and hence is *not* merely a logical construct), but is a concrete event or process. It is composed of the consciousness events in the subject field, which can be thought of as its temporal parts in subjective time.

Some readers may be bothered by the idea of a whole whose parts are consciousness events. If consciousness events actually are events, then this whole probably is unproblematical; after all, the consciousness events in a subject history are related to one another in a most intimate way, and usually are spatiotemporally contiguous as well. But in the most general case, consciousness events cannot be supposed to be events; all we know for sure is that they are

instances of seeming. It is difficult to imagine how instances of seeming which are not events could be the parts of a whole! I will address these difficulties in the next technical note.

The definition of subject history, whether in the rigorous form above or in the informal version given earlier, reveals the following important properties of subject histories. A subject history is a single stream of consciousness; it cannot be, for example, two parallel streams of consciousness, or a swarm of disconnected consciousness events. The connectedness condition on the subjective precedence relation R insures this uniqueness of the stream. The stipulation that the subject field is nonbranching implies that for each consciousness event x in the subject history, there is a unique, linearly ordered series of consciousness events in the history which lie in the *near* subjective past and future of x (provided that x has a subjective past and future). That is, some segment of subjective time around x has a linear topology. The maximality condition on a subject field insures two things: (a) if a consciousness event x in the history of a subject gives way to some consciousness event y (that is, if x is continued during some y), then some such y also is a part of the history of that subject; (b) if a consciousness event y in the history of a subject has some consciousness event x in continuance, then some such x is part of the history of the same subject as y. In other words, the subject history does not begin later than, or end earlier than, the stream of consciousness. Hence any consciousness event which is part of the same nonbranching "stream of

consciousness" as an event x will belong to the same subject history (or histories) to which x belong(s).

This definition of subject history captures the informal notion of subject identity which I explained informally above. Intuitively, two consciousness events are events in the career of the same subject if and only if they belong to the same subject history.

Note 2: The Ontology of Subject Histories

Intuitively, one may think of a subject history as an event — specifically, as a temporally extended event which has consciousness events as parts. If a consciousness event is indeed an event, then my definition of a subject history agrees with this intuition. However, there is no *a priori* guarantee that all consciousness events really are *events* in the usual sense, or are items that happen in physical time. Thus, we cannot rule out subject histories which are not events or which do not occur in physical time. However, we are safe in regarding a subject history as a certain kind of whole having consciousness events as parts. If the consciousness events really are events, then the history is an event.

A further question arises when we consider the whole which the consciousness events are supposed to form. If consciousness events really are events, then it is possible to assume that these events form a whole, especially in view of the intimate way in which the events are interconnected. This plausibility increases if the events are, for the most

part, contiguous in time and space — as neural events in a single brain might be. It is likely that all consciousness events are events, so a whole composed of consciousness events probably is no more problematical than any other events composed of multiple temporal parts. However, we have not assumed that consciousness events are events. Would instances of seeming which are *not* events form wholes in the required way?

The answer to this question is implicit in the definition of consciousness events as instances of seeming. In Chapter 2, I pointed out that the existence of an instance of seeming or consciousness event does not involve anything over and above facts about how things seem. There is nothing more to the existence of a consciousness event than the obtaining of certain subjective facts. A similar statement can be made about wholes composed of consciousness events. The claim that there is a subject history says nothing more about the world than does the claim that consciousness events of certain sorts exist. (The required sorts of consciousness events include consciousness events for which other consciousness events exist, and which are ordered by this interrelationship in a certain specific way.) This last claim, in turn, says nothing more about the world than does the claim that things seem certain ways in certain instances. Thus, the claim that there are subject histories is as secure as the claim that things seem certain ways. The ways things must seem to make a subject history exist are rather specific; certain instances of seeming must seem in certain other instances to exist, as detailed in the definition of a subject

history.

Note that we may interpret quantifiers over subject histories substitutionally, as we did for consciousness events (and for the same reason).

Those who truly detest the idea that instances of seeming form wholes are free to adopt some other view of what a subject history really is. For example, one might think of a subject history as a *property* of consciousness events. All the consciousness events in John's subject history could be regarded as possessing a common property — say, that of being a "John-consciousness event." One could just as well regard John's subject history as a class of consciousness events (that is, identify the history with its subject field). One might even think of a subject history as a state of affairs involving consciousness events. For example, one can take the real content of "there is a John-history" to be the fact that there are John-consciousness events and non-John-consciousness events in the world. All of these alternatives, particularly the one involving classes, amount to the use of logical constructions as subject histories. As I said earlier, my aim in this book is *not* to find logical constructions which will substitute for objects, but to learn something about the objects themselves.[32] I mention these three alternatives, not because I advocate them, but because they allow those who reject my characterization of subject histories to continue reading the book. One can accept much of what comes later in this book without believing that subject histories are wholes made of instances of seeming.

One might wonder whether subject histories even need to

fit into any of the standard ontological categories. Entities as special as *changing viewpoints* or *streams of seeming* might not exactly fit under any other heading. Perhaps subject histories are just — subject histories!

Note 3: The Topology of Subjective Time

The relations of continuance and of subjective pastness have certain formal properties which possess clear psychological meanings. Some of these properties follow from the definitions of continuance and of subjective pastness; others cannot be obtained deductively, but are suggested by ordinary experience. Here I will review some of these properties very briefly.[33] This note presupposes a knowledge of the elementary theory of order, such as is discussed in texts on set theory.

Reflexivity. In ordinary experience, the relation of continuance is irreflexive; a consciousness event does not "contain" itself in the way in which a consciousness event "contains" another consciousness event in continuance. However, the definition of continuance offers no prima facie guarantee of this. Similarly, in ordinary experience subjective pastness is irreflexive; a consciousness event is not experienced later than itself. But the definition of subjective pastness does not guarantee this. Also, the irreflexivity of continuance does not imply the irreflexivity of subjective pastness.

Symmetry. Reflection on everyday experience suggests that continuance is antisymmetric. A human being normally does not have a consciousness event a, then have another consciousness event b in which a is continued, and then immediately have a again. However, the definition of continuance does not, prima facie, exclude this possibility. Also, we have no *a priori* guarantees that subjective pastness is antisymmetric. The antisymmetry of continuance does not imply the antisymmetry of subjective pastness. If subjective pastness failed to be antisymmetric, then there could be consciousness events x and y such that x is both before and after y in subjective time. This would happen if the topology of the subjective time of a subject were closed.[34] The irreflexivity of subjective pastness also could fail under these conditions. Such things might happen to a physical observer in a universe which has closed time or permits time travel. I do not know of a way to rule out this possibility.

Transitivity. In our ordinary experience, continuance is not transitive. If it were, then a subject could, at any moment in his/her history, notice all of his/her past experiences in continuance. Such a subject would experience his/her entire past as immediately past; that entire past would seem that it had "just happened." If a subject history (as I have defined it) were like this and also contained more than two consciousness events, then there would be branches in the subject history (a distinct

consciousness event would have to continue more than one consciousness event). The definition of subject history rules this out. Hence there cannot be a subject history (as defined above) in which continuance is transitive, unless there is a subject whose history contains only two consciousness events. For such a short-lived subject, continuance would be vacuously transitive.

Trichotomy and nonbranching. In ordinary experience, continuance does not obey the trichotomy law on consciousness events in a subject history. If x and y are consciousness events in the same subject history and x is in the distant subjective past of y, then x is not continued in y, y is not continued in x, and y is not identical to x. Subjective pastness, restricted to a single subject history, obeys the trichotomy law.

The trichotomy of subjective pastness is an important feature of subjective time. Subjective pastness in a subject history obeys a trichotomy law: for consciousness events x and y, either x subjectively precedes y, or y subjectively precedes x, or x is y. (Since we have not ruled out universes with closed time, we cannot generally regard these "or's" as exclusive.) This trichotomy law excludes cases in which two or more streams of consciousness are parts of the history of the same subject. For example, if a subject splits to give two subjects, the resulting pair of streams of consciousness do not make up the history of a single subject. (I will discuss puzzles about splitting and merging subject histories in Chapter 12.)

For partial orders, trichotomy is known to imply the absence of branches in the order. This implication does not hold in general for the subjective pastness relation; since we cannot rule out the possibility that this relation is topologically closed, we cannot be sure that it is a partial order. Hence a separate nonbranching condition is needed in the formal definition of subject history (recall Appendix A).

Local properties. Subjective pastness also has a significant local topological property: for a subject history with more than two consciousness events (or for any subject history which is not closed), the subjective pastness relation is a linear order when restricted to a sufficiently short segment of the subject history. This is a direct consequence of the definition of subject history.

Summing up: By using the definitions presented in this chapter, we can show that the subjective pastness relation is transitive, and is trichotomous (in a nonexclusive way) if restricted to a single subject history. Ordinary human experience suggests that for human consciousness under ordinary conditions, continuance is antisymmetric and does not obey trichotomy, and that subjective pastness is irreflexive and antisymmetric. For subjects having three or more consciousness events, continuance is not transitive. Subjective pastness behaves like a linear ordering over sufficiently short stretches of an ordinary (that is, non-closed) subject history.

Chapter 7

The Flow of Time

In this chapter I will examine one of the most important and puzzling features of the world which we experience. This feature is the flow or movement of time. The phenomenon of time's flow, or *temporal flux* as it often is called, is the subject of some philosophical problems. The greatest riddle about the flow of time is the question "Is it real or merely apparent?" Near the end of this chapter, I will propose an answer to this question. I will conclude that the flow of time is indeed real, although it is not what many philosophers of time suppose it to be.

The notion of temporal flux occupies an interesting place in the history of philosophy. Some philosophers have held that the flow of time is an objective feature of the world. According to this view, the present moment really does move, in some sense, from the past toward the future, and the existence of past and future things (if such things exist at all) may differ somehow from that of present things. Process philosophers even have held that temporal flux, or

something closely akin to it, is the very foundation of reality.[1] On the other hand, some philosophers have denied the reality of the flow of time. These thinkers have argued that the apparent movement of time is (in one way or another) an artifact of our perceptions; often they have tried to reduce this movement to relationships among tenselessly existing events or to some other nonmoving substratum.[2]

Throughout this chapter I will make free use of examples about physical objects to support my conclusions about time. One might think that the facts used in these examples go beyond facts about how things seem. However, they usually do not. Most of the descriptions of physical objects in this chapter actually are descriptions of how physical objects appear to observers; hence these examples actually are examples of how things seem. Physical object examples which cannot be read in this way belong to the second part of the project of this book; those which can be read as arguments about how things seem may belong to the first part. In a similar spirit, I will make use of some facts from physics to buttress certain steps in the argument.

Temporal Flux and Bergsonian Duration

To kick off this discussion of temporal flux I will examine the concept of *duration* as set forth by the French philosopher Henri Bergson. My aim in doing this is not to champion Bergson's philosophy as a whole, but to better understand the notion of temporal flux. Bergson's view of

time, to which this chapter owes much, is the prime example of a philosophical view on which temporal flux is real and irreducible. According to Bergson's view, temporal flux is something distinct from, and not reducible to, the temporal ordering of events.

In ordinary usage, the word "duration" refers to length of time, and secondarily to the persistence of objects through time. According to the latter usage, an object endures if it exists at each time during some interval of time. Some philosophers use "duration" in this way. But Bergson used "duration" to refer to a special aspect of time which cannot be reduced to the relations of order and temporal distance which hold among instants and events.[3] This special notion of duration is the one I will examine here.

Bergson understood duration as a sort of pressing forward of the present toward the future.[4] The Bergsonian conception of duration cannot be explained in a few sentences; the reader is referred to Bergson's works for a full account. The example of the next paragraph, loosely based on one of Bergson's,[5] illustrates one particular aspect of this conception.

Consider what happens to a coffee cup between 12 noon and 12:02 pm on a given day. Suppose that the properties of the cup do not change during the interval from 12:00 to 12:02 — that is, nothing happens to the cup during that interval except that the cup continues to exist. Consider the part of the career or history of the cup which extends from 12:00 to 12:01. (This part is what sometimes is called a

"thing-stage."[6]) For convenience, let us call this part A. Now compare A to the longer part of the cup's career lasting all the way from 12:00 to 12:02. Call this longer part B; note that A is a temporal part of B. During B, as during A, the properties of the cup do not change; seemingly, nothing happens to the cup during either A or B. But further reflection reveals that something does happen to the cup during B that does not happen during A: after A ends, the cup *exists some more.* As the cup persists through time, it exists, and then exists some more, and then exists yet more. This is what is "happening to" the cup during the entire length of B. This "existing and existing" is what we may call the *enduring* of the cup. It is something that goes on even in the absence of changes in the cup.[7]

This example illustrates a fact about duration which is implicit in Bergson's thought but which a naive understanding of duration may overlook. This is the fact that if an object is persisting through time, *something is happening.* To see this "something" happen, just pay attention to any physical object. As one watches the object, the object persists; as one continues to watch the object, it persists, persists, and persists some more, even if one does not witness any change in the object, and even if the object in fact does not change. This fact of things' "persisting and persisting" is one aspect of what Bergson called "duration." The kind of duration which I have just described is a feature of a thing which is different from the mere existence of that thing through an interval of time. It is something that goes

on at *each* instant of time; at each moment in its history, an object is busy enduring. Duration of this sort is a simple flowing-onward of things. Like Bergsonian duration, this duration is distinct from any time-ordering of the stages of a thing's existence (it is not a mere relation among those stages), and from any metrical, or distance, properties of time (it is not a mere measure of time interval).[8]

The above informal remarks are not intended as a precise definition of duration or as an argument for the reality of duration of the Bergsonian sort. I must stress that they do not do full justice to Bergson's rich idea of duration, although they do capture one side or facet of that idea. They are meant only to paint a portrait of duration as it appears in everyday experience. Now I will attempt to make this informal notion rigorous.

Think of the coffee cup again. Consider a brief slice of the history of the cup, centered at 12 noon on a particular day. Take the slice to be instantaneous or of very short length. In philosophical terminology, this slice is called an *object-stage*.[9] Call this object-stage S.

According to what I said before, duration is something by virtue of which an object, as it is now, plunges forward toward the future.[10] Hence duration must be something present at each stage in the career of an object. One might say that duration is a feature which belongs to the state of an object, and which ensures that the object will go into other object states at later times. (This description will be useful later, when I will look at the concept of duration in a new

way — one which Bergson probably did not foresee.)

What does the cup's possession of duration imply? At very least, we can say this: Because the cup has the property of duration at 1 pm, the cup at 1 pm *already is in transition* from S to subsequent object stages. At the time when S becomes the cup's present stage, S already is giving way to a future object-stage of the cup. An attempt to examine the cup while it is in a stage S does not reveal a static moment in the history of a cup. Instead, it reveals a view of the cup already passing from S into subsequent object stages. Metaphorically speaking, we can say that the cup *refuses to sit still* at the stage S.

This fact that the cup "refuses to sit still" in time is at least part of what we mean when we say that the cup "endures" — at least if we understand duration in roughly the same way Bergson did. While the cup is at stage S, the cup is enduring; it is enduring because the fact that it is at S implies that it is going to be at other stages at later times. The fact that S is going to lead to other stages in this way is a feature of S itself. When the cup is at the stage S, something is happening to the cup that will take the cup out of S and into other stages. Speaking loosely once more, we can say that the cup endures because each object-stage in its history has the property of giving way to other object-stages. That is, an object endures if its object-stages are transitory *by their very nature* — not merely "transitory" in the conventional sense of occupying a short stretch of time.

Thus, the transitoriness of an object-stage of S consists in a certain kind of implication of other object-stages. The fact

that the object-stage S exists implies that future object-stages exist; hence the object to which the stage S belongs is, in a sense, pressing forward into the future. Of course, the object may cease to exist, in which case some final object-stage does not meet this criterion; but that final object-stage still is transitory, because its existence follows from that of some other object-stage and is followed by nothing (at least by no object-stage of the same object).

Our experience of this transitory character of momentary states lies at the core of the intuitive feeling that time flows. The fact that the present situation gives way to future situations is what leads us to believe that time really "moves." This transitory character of the moment is not the only feature of the world which might be called the "flow of time." In particular, the fact that events seem to "move" toward the past from the future, becoming present for an instant in between, makes time resemble a flow.[11] But one does not need to perceive this last kind of "movement" to have an impression of the ephemerality of the present or of the "flowing" character of time. One has only to look at the present moment in the right way. The fact that the present moment is yielding to another moment is what makes time "fly."

The apparent movement of events differs in significant ways from the kind of duration described above. In particular, a flow of events toward the past would depend upon changes in the locations in time of those events, but "duration" as I have described it is a feature of an object at a *single* time. I should add also that D.H. Mellor has provided

an analysis of the apparent movement of events within a tenseless theory of time.[12] If one believes this analysis (and I think it is at least plausible that some analysis of this general sort can work), then the apparent movement of events can occur even in a world lacking what I call temporal flux. (Note that I am not endorsing all of Mellor's views on tense here, only his conclusion that time can seem to flow in a tenseless world. Elsewhere I will endorse another of Mellor's views about time.)

The following quasi-formal definition of temporal flux is motivated by the above remarks.

> Let X be an object and t a time. X is *in temporal flux* at t if and only if either:
>
> > (1) at t, X is in a state S for which the following condition holds: that X is now in S necessarily implies that at some time t' later than t, X will exist;
>
> or
>
> > (2) there is a time t" earlier than t such that at t", X is in a state S such that the fact that X is in S at t" necessarily implies that X exists at t, and t is the last time in the history of X.

Note that I used "necessarily implies" in this definition, instead of just "implies." The appropriate notion of

necessity here is what philosophers call physical necessity. That is, it must be physically impossible that the antecedent holds but the consequent fails.

The times referred to in this definition may be taken to be the physical times measured by some standard clock, or they may be taken to be moments of subjective time — that is, consciousness events in some subject history. Hence we can speak of temporal flux in physical time (as measured by some specified clock) or of temporal flux in a particular subject's subjective time.

Someone might object that this definition is inadequate because it does not fully capture the intuitive notion of temporal flux. With most of this objection I heartily agree; I concede that the definition does not capture every feature of time that someone might consider an aspect of the flow of time. Certainly it does not embody the entire content of Bergson's idea of duration. (Some of the content of that idea may be inexpressible in ordinary language.) However, the claim that my definition is inadequate on these grounds misses the point. That definition was intended only to capture the experienced *transiency* or *ephemerality* of time — the fact that moments have the property of giving way to other moments. Adopting a term which other authors have used somewhat differently, I will call this latter feature of time its *transitionality*.[13]

Understood in this way, temporal flux is not reducible to relationships of temporal order or distance among instants, dates, or events. The before-and-after relations among events are insufficient to guarantee the existence of flux.

Temporal flux, or time's transitionality, consists in the fact that each moment of history is, by nature, a transitory entity — an entity which, by its nature, must give way to new moments. It does not consist in the fact that different times or events stand in some ordering relation to each other.

Temporal Flux in Sense Experience

My aim in this section is to show that temporal flux, as I defined it in the last section, is a feature of the world as it seems. More precisely, I will show that the apparent physical objects which exist for our awareness are in temporal flux with respect to our streams of subjective time (if these objects exist at all). This conclusion is supported by certain conspicuous facts about our everyday sense experience. It also is supported by current theories of physics, which describe or summarize the behavior of the apparent physical world.

Consider what happens when you are standing on a street corner and you see a rapidly moving car. If you are like most people, you notice that the car is moving. Motion is change in an object's position over time, so you could discover that the car is moving by recording the car's positions at different times and drawing a conclusion from the data thus obtained. But you do not have to do this — at least not consciously. You simply notice that the car is moving.[14] It *seems* to you that the car is moving. In other words, it is the case for some of your consciousness events

that motion is occurring.

Although humans can perceive motion, this perception may depend upon the neural integration of many stimuli. Some animals apparently have specific kinds of visual sensations of motion as well. Some vertebrate nervous systems — those of frogs, for example — appear to have a capacity for seeing motion which is not shared by humans, at least not in the same degree. Frogs, for example, can see moving bodies well; their eyes (not only their brains) can react specifically to variations in brightness.[15] In view of the differences in reasoning capacity between humans and frogs, it is implausible to attribute frogs' motion perceptions to conscious inference of any kind.

To notice that an object is moving, one does not look at that object at successive moments and use descriptions of the resulting observations to deduce that the object is moving. One simply can see *now* that the object is moving. One does not have to think consciously about the fact that the object's position now differs from the object's position later. This fact suggests (though it does not strictly imply) that the movingness of a sensible object is a property of the state the object is in *now* — that is, at a single time. It is not merely a property of a set of consecutive positions in the object's history.[16]

If the time with which we are concerned is subjective time as described in Chapter 5, then this suggestion is correct. The fact that an object is moving can be the case for a single consciousness event. The motion of an object in the visual field does not consist simply in the occupation by that object

of different positions in the field at different times. Motion sometimes is part of the way things seem.

(A physicist might object to the preceding paragraph on grounds of relativity: since motion is relative, the objection goes, there is no such thing as a property of "movingness" which an object can seem to have. This objection disappears when we note that the required property of "movingness" is a perceptible quality and hence is relative to a subject. Since the subject has a location and a velocity, the motion relative to the subject is indeed a relative motion.)

The above argument that sense objects are in temporal flux raises some questions. The argument shows that physical objects are in temporal flux in *subjective* time. But this does not show that physical objects are in temporal flux in *physical* time — that is, in time as measured by clocks. (Such time can be measured even if one is not prepared to assume the objective existence of physical objects. One simply uses the apparent clocks in one's experience.) This kind of temporal flux is harder to establish using ordinary experience, because it is hard to ascertain, from ordinary experiences, whether an object is in the kind of state required by the definition of temporal flux. An object cannot be in temporal flux unless it is in a certain sort of state at a single time, but one cannot observe an object for just one instant of physical time. There are physical as well as physiological reasons why this is impossible; events in the nervous system require finite amounts of time, and the uncertainty principle seems to entail that a physical process involving finite amounts of energy cannot be localized

precisely in time.[17] (The uncertainty principle allows much more precise time measurements than do the limitations of the human nervous system; recall what I said in Chapter 3 about the time required by a consciousness event.) In looking at a moving object, one sees the object as it goes through more than one instantaneous state. Hence one cannot be sure that anything that one sees can be taken to be a property of the object at *one* such state, rather than a property of a short segment of object history.

Some facts about the physics of moving objects suggest that motion is a property which an object possesses all at once, at each single instant of time. If one could look carefully enough at a moving car, one would find features of the car which could yield information about the car's state of motion at an instant. For example, a spinning wheel experiences internal stresses due to effective centrifugal forces engendered by its rotation.[18] These stresses distort the shape of the wheel. A complete list of all the physical properties of a moving car at a fixed time would have to include the stresses in its wheels and the resulting distortions as well. Even if time were composed of true instants of zero temporal length, and even if one could take a snapshot of a moving car at a single such instant, one still could notice this distortion in the snapshot. There are other instantaneous features of this same general sort — for example, the distortion of the car's tires due to their rolling friction on the road.[19] If one digs deeply enough into physical theory one can find even deeper features of this kind. The relativistic

contraction of an object's length is one such example; another is the object's quantum mechanical de Broglie wavelength. (For normal macroscopic objects this is too small to measure by ordinary means, and for objects moving at ordinary speeds the relativistic contraction due to motion is well known to be practically immeasurable.[20])

The view that an object's state of motion is part of that object's instantaneous state is deeply embedded in physical theory. Classical physics makes extensive use of the concepts of velocity and momentum, which are properties of the object's instantaneous state of motion.[21] At a given time in its history, a classical particle has such-and-such a value of velocity and such-and-such a value of momentum. In relativity theory, the concepts of 4-velocity and 4-momentum supersede the classical concepts of velocity and momentum; these "4-vector" quantities, unlike their classical counterparts, are the same in all frames of reference.[22] According to quantum mechanics every physical object possesses a de Broglie wavelength. This wavelength is a measure of the spatial variation of the object's wave function, which characterizes the object's state at a fixed time. In quantum theory, an object's de Broglie wavelength is inversely proportional to the object's momentum. Thus the object's state of motion is fixed by a property that the object can possess all at once at a single instant.

These examples from physics are not really necessary to my argument. They are meant to illustrate the claim that a moving physical object has, at each instant in its history,

properties which no stationary object can possess. Even without the assumption that Newtonian, relativistic, or quantum mechanics is correct, one can find in everyday experience examples of properties possessed at an instant by moving objects and not by stationary objects. The distortion of tires is among the most mundane of these examples.

Thus, ordinary experience and physical theory both agree that the state of motion of a physical object at a time is a property which the object possesses at that time. This property is an aspect of the object's state at time t. This finding has important consequences for our understanding of the nature of motion. States in the career of an object which moves relative to some observer are not the same as any states which might be found in the careers of objects which do not move. In other words, the history of a moving object cannot be built up from states taken from the histories of nonmoving objects (or of objects in different states of motion). The state of an object at a single time includes the object's state of motion. This state of motion is not merely a property of a stretch of the object's history during which the object actually moves. Instead, it is a property which the object has in its entirety *now*. One might say that a state of a moving object now is a *moving-object state* which is not identical to any *resting-object state*. The career of a moving object (moving in a given reference frame) cannot be divided up into a series of states indistinguishable from states of objects at rest.

We have arrived at one of the key ideas of Bergson's view of time, or perhaps at an updated version of that idea.

Bergson recognized that a motion is not simply a sum of instantaneous states of rest.[23]

The state of motion of a physical object is a property whose possession by that object implies that the object will enter states other than its present one.[24] (Of course, it will not enter those states if the object loses that property. An object can lose its state of motion by being broken to bits, by being stopped by a wall, or in other ways.) Any object that has a property of this kind is in temporal flux as defined in the last section. Therefore, every moving object is in temporal flux. But every sensible object of which we know is in motion in some frame of reference or other; ordinary experience tells us this (you always can start moving away from a stationary object), and physical theory concurs. Hence every sensible object of which we know *endures*, in the Bergson-reminiscent sense of being in temporal flux.

How Events Happen

We all know that events happen. If there is anything safe that we can say about events, it is that they happen. But the fact that events happen is not as simple as it seems. It is a fact which we could understand better than we now do. To begin to understand it better, we must first understand what it means for something to happen.

When we say that events happen, we are asserting that events have a particular property. This property stands in a close logical relationship to the property of temporal flux.

The gunshot example in Chapter 4 gives us a hint of the nature of this property. First the awareness of the noise happens, then that awareness fades away as other things (including continuance) begin to happen. The earlier consciousness event is over and done with, and *gives way* to a later consciousness event. In short, the first event doesn't remain present statically, like a stone statue — it happens and is replaced by *something else*. This transitoriness of a perception of a loud noise is closely analogous to the transitoriness of object-states in the history of an object. If C and D are consecutive parts of an observed event, then one can notice, not only C and D, and not only the fact that C precedes D, but the turning of C into D, the giving way of C to make room, as it were, for D.

This fact about observed events lies at the bottom of the truism that *events happen.* When we say that an event happens, we are saying, more or less, that its earlier stages give way to its later stages. Just as a persistent object engages in *enduring* when earlier moments in its history yield to later ones, so an event engages in *happening* when its earlier temporal phases yield (in a similar way) to later ones. It is plausible to think of happening as the defining property of the class of events; events are just entities that happen.

We can define happening by analogy with our earlier definition of temporal flux.

> x *happens* if and only if x has a part y which is present at a time t, and is such that the fact that y is present at t

> necessarily implies that some other part z of x will be present at some time t' later than t.

Again, we can define this with respect to either physical or subjective times. The necessary implication is of the same sort used in our earlier definition of temporal flux.

It is important to note that both temporal flux and happening are defined in terms of temporal notions — namely, existence at a time and the relation of temporal order. Happening and temporal flux may not be reducible to the temporal ordering of events, but they do logically require the existence of that ordering. Thus we cannot correctly speak of something happening or enduring without specifying a series of times in which it happens or through which it endures. An entity might happen or endure in some subject's subjective time. It also might happen or endure in objective time, with the times in the definition of happening and duration read as times on some clock. In the sequel I will be concerned mainly with happening and temporal flux in subjective time. In this case, the "moments" or "instants" of time will be consciousness events. Sometimes I may make general statements about happening and duration without specifying a particular set of times. In these instances, the statements are intended to be applicable either to subjective time or to clock time.

Some Technical Notes on Instantaneous Events

The above definition of happening has two important technical consequences for the metaphysics of events. One is that instantaneous events do not happen, though they may exist. Another is that the happening of an event is not reducible to relationships of temporal order among the temporal parts of that event. I will take up these consequences in turn.

According to our definition of happening, the happening of an entity requires the possession by that entity of at least two parts which exist at different times. This rules out the possibility that an instantaneous event happens, if by an "instantaneous event" we mean an event which is localized entirely at a single instant in some series of times. (More precisely, it rules out the possibility that an event happens with respect to any series of times in which that event is instantaneous.) Perhaps the above definition of happening arbitrarily leaves out this peripheral case of instantaneous events. If it does, then my earlier statement that "events are just entities that happen" must be amended to read "events are either entities that happen or instantaneous events." (Alternatively, one could say that instantaneous events, if there are any, are not really events.) But the definition of happening does not beg the question of the existence of instantaneous events, if by "instantaneous event" one means something like "entity occupying only one instant of time."

All that is at stake is whether such instantaneous entities can correctly be said to happen — not whether they can be.

The view that a genuinely instantaneous event does not really "happen" seems reasonable. An event which truly takes no time does not involve any change or any duration; nothing goes on while such an event is present. An instantaneous event simply *exists* briefly; nothing actually *happens* during its presence. It does not even have a normal beginning or ending. The moment of its "ending" is that of its "beginning"; its ending and beginning are not distinct phenomena, and are coextensive with its presence. It is less confusing to regard such an entity as a very short-lived entity which does not embody any happening, than to regard it as an event of a pathological sort.

All this does not affect in any way the use of instantaneous events as a convenience in theoretical physics. In common physical usage, an event of zero duration represents an idealized limiting case of a very short-lasting and spatially small event. A real event need not be assigned a precise, single location in spacetime, so long as events can be located as closely as is necessary in practice.[25]

Another consequence of my definition of happening is that the happening of an event does not consist simply in the event's being extended in time — that is, the possession by that event of earlier and later temporal parts. The temporal parts must be there, but they also must yield to each other in a particular way or the event does not happen. Happening, as defined here, does not consist in a particular arrangement in time of the parts of an event. It requires the existence of

temporal parts in an event, but is not reducible to temporal order. The temporal parts in the definition of happening are transitional or ephemeral, in the same way that the object states in the definition of temporal flux are transitional or ephemeral. Earlier I said that temporal flux is a property that an object has now, all at once; this property is not reducible to a mere temporal ordering of object states. A similar remark is applicable to happening and events. Happening is a property that an event has now, all at once, in the sense that a very brief present temporal part of the event can have the transitionality that confers happening on the event. Transitionality is not reducible to a mere ordering of temporal parts.

Incidentally, there is no guarantee that all the temporal parts of an event happen. In principle, there could be non-happening parts of events. Every event would have such parts if time were continuous and every event were a continuum of instantaneous events.

More Technical Notes: Duration and Happening

Earlier I said that happening has close logical ties with temporal flux. Now I will explore some of those connections.

An entity in temporal flux at time t is in a certain state at t. The fact that it is in that state implies that later the object will be in some other state, if it exists at all after t. A

happening entity has a temporal part, the existence of which implies the existence of some future temporal part. Thus the concepts of happening and of temporal flux are somewhat symmetrical to each other. This is not surprising, since both concepts capture the same underlying feature of reality — the transitionality of time. That things are in flux is equivalent to the transitionality of stages in the histories of things; that events happen is equivalent to the transitionality of events' temporal parts.

It is not hard to show that if there is a happening event which is part of an object's history, then that object is in temporal flux. The following argument shows this. Suppose that persisting object O has an event E in its history, and that E belongs entirely to O's history (that is, every temporal part of E is part of O's history). At very least, E's being in O's history implies that while E is happening O has a certain property — that of having an event of such-and-such a kind happen to it, or of being involved in an event of such-and-such a kind. Each of E's temporal parts E_1, E_2, ... confers analogous properties upon O at various times. But E happens; hence the presence of E_1 necessarily implies the later presence of another temporal part of E, say E_n, which is not identical to E. This implies that one of O's states includes a property (being involved in E_1) whose possession by O entails that a later stage in O's history (when it is involved in some E_n later than E_1), O will be in a state different from S. Thus O is in temporal flux.

The converse conclusion — that if an object is in

temporal flux then it has happening events in its history — follows if one assumes that an object in temporal flux passes through temporally extended object-*stages* (as well as object states). If an object-stage is temporally extended, then it has shorter object-stages as temporal parts; whether or not these shorter stages happen, they do give way to each other in the manner described in the definition of happening. It follows that the career of an object in temporal flux, if it contains any object-stages at all, contains temporal parts that happen. Mellor, considering objects which do not change, has argued that "thing-stages" (what I have been calling object-stages) should not be regarded as events.[26] But even if one does not regard object-stages as events, one can derive the weaker conclusion that an object-stage *happens* if it is in the career of an object in temporal flux.

If object-stages happen but one chooses not to count them as events, then one could further revise my earlier remark that "events are just entities that happen," to read "events are either entities that happen or instantaneous events, and entities that happen are either events or object stages."

Tense, Temporal Motion, and Time's Flow

In this section I will point out some differences between temporal flux and two other temporal notions to which it is conceptually close. These are the notions of *tense* and of the *movement of time.* (I already have discussed the movement of time, though briefly.)

The problem of the reality of tense is one of the central problems in the philosophy of time. I will not attempt here to discuss this problem in detail. Instead I will refer the reader to the literature, and in particular to the works of John McTaggart and of Mellor, for discussions of the problem and of proposed solutions.[27] Occasionally I will use the terminology of "*A* series" and "*B* series" which these authors have used. First I will explain these terms as I understand them.

The *A* series is the series of tenses, or possible positions relative to the present, which an event can occupy. The main tenses are the past, present, and future tenses; hence the past, present, and future are parts of the *A* series. So are more specific tenses, such as yesterday and five days ago. Since both yesterday and five days ago represent the positions of certain events relative to the present, they both are tenses in the philosophical sense. They form parts, as it were, of the past tense.

The *B* series is the series of all *dates*, or absolute positions in time, which events can occupy. The year 1900 is an example of a date. There is nothing that makes a particular date intrinsically past, present or future. During 1900, the year 1900 was present; in 1901, that year was past, and in 1899 it was future. Other examples of dates are: exactly midnight on January 1, 2001; the day the *Titanic* sank; and the microsecond during which a particular nuclear reaction occurred. All of these are dates rather than tenses; they can be described without reference to the present.

If the flow of time is objectively real, then there is more

to time than just the temporal ordering of events. The apparent existence of temporal flux (in the naive sense, not my rigorized one) suggests that events really do pass from being future to being present and from being present to being past. This lends great plausibility to the commonly held view that temporal flux depends upon changes in tense.[28] The transiency of moments, which we call time's flow, seems to involve in an essential way changes in the tenses of dates and of events. Without changes in tense, it seems, there could be no real passing of the present into the past. Thus the existence of real flux might be thought to require the existence of an *A* series of real tenses.

Despite its plausibility and popularity, this latter belief is incorrect. *Neither temporal flux nor happening requires the reality of tense.* To see why this is so, consider the history of a persisting object in a hypothetical tenseless universe. This history is composed of a series of object states. There is no reason why one of these states could not possess some feature which compels other states in the object's history to exist. For example, the object state S might be such that an object which is in S has a certain quantity of energy. Suppose that the law of conservation of energy holds in the world we are imagining. Then if an object is in object state S, there must be an object state of some kind after S, for otherwise the energy of the object in S would be lost at times later than S. Even if the object disintegrated, there would have to be something afterwards which possessed the "lost" energy. And as long as the object itself continues to exist, its being in a given momentary state necessarily

implies that there is a later state; this later state cannot be identical to the earlier state due to its temporal relationship to that earlier state. Thus, an object in a tenseless universe could be in temporal flux without undergoing any changes in tense. An event in the history of such an object could be a genuine *happening*, could be genuinely ephemeral and transitional, without undergoing any changes in tense.

The transitionality of the moment embodied in the concepts of temporal flux and happening does not depend upon the existence of changes in tense. Temporal flux and happening are properties that an object possesses *regardless of its real or apparent tense.* The essence of temporal flux and of happening lies not in some present entity's becoming past, but in the fact that some entity compels another entity to exist in the future. Both entities really embody transitionality, happening, or flux — but these entities do not need to change in tense, or even to have tenses, to do so.

The existence of flux and of happening does not require any actual movement of time, such as a movement of events from the future toward the past. Any such actual movement requires the existence of tense in some form. Since flux and happening do not require tenses, they do not require this movement.

The reality of flux and happening is equally compatible with the reality of tense and with the unreality of tense. The existence of entities (things or events) that are in flux, or of entities that happen, does not require or exclude the possession by those entities of tenses, or the movement of those things from one tense to another. Hence the thesis that

flux and happening are real cannot be used to argue that tense is or is not real, and neither the reality nor the unreality of tense has much bearing on the reality of flux and happening.

Of course, if the existence of tense is contradictory, as McTaggart and Mellor have claimed,[29] then *nothing* is logically compatible with the existence of tense. The arguments of McTaggart and Mellor against the reality of tense show that the concept of tense raises certain logical problems. One does not have to agree fully with the conclusions of these arguments to recognize this problem.

The connection between tense and the reality of the past and future bears mentioning in this context. According to many people's feelings, the past does not exist anymore and the future has not yet come to be. Many people feel that neither the past nor the future is fully and genuinely real.[30] This outlook amounts to a rather overwhelming version of the thesis of the reality of tense; clearly it implies at very least that there is a present tense. The existence of temporal flux and happening does not depend upon the fate of this outlook. The definitions of temporal flux and of happening do not require us to hold that future or past objects exist; whenever they speak of future or past entities, they can be revised to speak of entities that will exist or have existed, rather than to future or past entities which do exist. One can apply these definitions to things and events regardless of whether the future or the past is real. Also, the existence of temporal flux does not entail that past and future events are in any sense less real than present ones. The fact that an

object is in flux does not make any of that object's states or stages less real than any others.

Summing up some of the conclusions of the last few paragraphs, we can say that the reality of temporal flux is independent of the reality of tense and of the movement of time. Flux, happening, and transitionality can exist in a world in which only the *B* series, and not the *A* series, is real.

In a world in which there is no *A* series, every feature of time can be reduced to something which exists tenselessly and unchangingly. A real flow of time closely resembling Bergsonian duration is precisely the sort of feature one would least expect to find in such a world. One might object on these grounds to my thesis that transitionality can exist in a tenseless world. However, this objection misses the point, for reasons set forth in the last few paragraphs.

One easily can turn this objection around to show that no *B* series theory of time can be correct *unless* there is transitionality in the world. Happening is not a byproduct of the temporal ordering among events; it is a feature of the individual events themselves. An event could happen even if it existed in a universe lacking any other stages or events besides its own temporal parts. Every *B* series approach to time of which I am aware takes the notion of event, or some related notion like time or date, as fundamental. On some views, instants are constructed with the help of events[31]; at very least, times are identified and located with the help of events. No *B* series theory (at least none of which I know) categorically denies the reality of all events except non-

happening instantaneous ones. Thus, *B* series theories of time are theories about a world populated by temporally extended events — in other words, by *happening entities*. Therefore, any attempt to reduce away happening and related "fluid" features of time with the help of a *B* series account of time will fall into a vicious circle. As soon as one uses the notion of event in the foundations of the theory, one imports happening into the theory too — for an event (with the one possible harmless exception discussed earlier) is simply an entity that happens.

The reality of temporal flux or of happening does not imply the reality of tense, with all the possible logical headaches which that entails.[32] Nor does it imply any sort of "motion" of the present into the past or future. It does not imply that there is a "flow of time" in any sense requiring the existence of an *A* series. The flow of time is due to the happening of events and to the temporal flux of things, not to any relationship between objects and tenses.

Re-Charting the River of Time

To close this part of the discussion of time's flow, I will present a metaphor illustrating the difference between the tensed view of time and the view of time's flow for which I have argued.

Consider the well-known picture of the "river of time."[33] On the tensed view, there is a real flow of time; things floating on the river are carried downstream by the current.

An event is much like a fallen leaf on the river's surface, which is first upstream, now here, later downstream. In this manner events emerge from the future, reach the present, and disappear into the past.

The above metaphor embodies the *A* series view of time. On standard *B* series views, the river is replaced by a perfectly still pond. In this pond things just float on the surface without going anywhere. There are directions called "upstream" and "downstream" in the pond, but these directions are demarcated by something else besides a real flow. (Perhaps there are strings of clocks on the pond, with the downstream clocks in a string reading later times than the upstream ones. Perhaps the strange creatures in the pond simply are afflicted with *feelings* that the pond is a river.)

On my view of time, time is more like a river than a pond. The flow of the river, with all its restlessness and energy, is quite real. But events are not boats or autumn leaves continually floating downstream. Instead, these entities are like ripples in the water surface created by underwater rocks. Such ripples can be quite persistent, as anyone who has watched shallow streams knows. The ripples do not move from upstream to downstream, but the river really flows nevertheless. The ripples themselves, though stationary with respect to the river's banks, are filled with a restless flow. In this sense, they truly are moving, although their positions along the river never change.

The Objective Reality of Time's Flow

In the preceding sections I have argued that temporal flux and happening are properties of physical things and events. My conclusions there suffice to establish the reality of temporal flux and happening, granted the reality of the physical world. In this section I will explore another avenue to the conclusion that temporal flux and happening are real. I will argue that we can establish the reality of temporal flux and happening in subjective time without assuming the existence of either physical objects or physical events.[34]

To notice that an object is in temporal flux, one must notice that the present state of that object is giving way to new object states in the manner which I described in the preceding sections. To notice this, one must at least notice the state into which the object is passing. The perception of temporal flux in an object involves perception of the yielding of one state to another. This requires noticing that a state is "going away" and is being replaced by a new state. An experience of glancing at an object in a fixed state, without seeing it starting to enter into new states, is not an experience of flux. To see an object as being in flux is to see the object as it begins to move into new states. (One could try to create a counterexample to this by staring at an object which remains qualitatively unchanged, but even that experience is one of an object in flux — one in which states are being succeeded by new states that happen to be

qualitatively similar to each other, though standing in different temporal relations to those earlier states.)

Similar remarks hold for temporally extended events. To watch an event is to watch an event *happen*. To watch a fire is to watch a fire burn, at least for a moment. One cannot notice an event without seeing something happen, that is, without seeing a transition occur between brief temporal parts of the event — without seeing one brief temporal part transformed into another.

These facts about experiences of temporal flux and happening are sufficient to allay all doubts about the reality of these two properties, at least as they are found in *subjective time*. Consider the following description of what happens when a subject perceives that a temporally extended event happens. During a particular consciousness event E, a temporal part y of the event is perceived; in the consciousness event F which succeeds E in the subjective time order, another temporal part z of the event is perceived. The perception of the event must involve the perception of z's beginning to be present and of y's ceasing to be present; without such appearances, it would not seem that the event as a whole happens. Thus, the perception of y cannot occur *in full* — cannot be *finished* — without the perception of z. The fact that y is perceived implies that z is perceived in some manner or to some degree. Hence the subject's experience during the total event has two temporal parts in subjective time, and the existence of one part of the experience requires the subjectively later existence of the other part. Therefore, experience *happens* in the subject's

subjective time.

The upshot of all this is that an experience which seems to be a perception of a happening entity itself happens in subjective time. If that experience really is a perception of an event, then that event really happens too, at least in subjective time. This argument can be extended to cover temporal flux as well as happening (just replace perception of events with perception of objects which are in certain states).

G.J. Whitrow has argued for the claim that our experience of the passage of events cannot occur without a real passage of time.[35] Thus, my conclusion is a variant of Whitrow's, although Whitrow's argument (and conception of the passage of time) are rather different from mine.

My argument for the reality of temporal flux and happening in subjective time bears strong similarities to an argument which Mellor once deployed for a different purpose (to analyze our experience of the order of time).[36] It differs from Mellor's argument in that it emphasizes causality much less and links the objective temporal order of experiences much less directly to their apparent order. The argument presented here shows that an appearance of duration or temporal flow is an appearance of a special kind, having a metaphysical significance greater than that of appearances of any other sort. One can have a visual hallucination of an elephant even if there is no elephant. But to have an illusion that things are enduring or that time is passing, one must perceive falsely that one moment is passing into another, that objects really are moving, that an

event is transpiring, or the like. One would have to have an illusion of successive events or stages — an illusion which itself consists of experiences which are successive (at least in subjective time), an illusion which consists of a transitional succession of illusions. In brief, to hallucinate flux one must have a *flowing hallucination*, and to hallucinate happening one must have an experience that happens. Once I have hallucinated that an event has happened, already something has happened; my experience of the event happened. A similar remark holds for the hallucination that time has passed (another variant of Mellor's argument[37] could be used to establish this). The illusion of time is not an ordinary illusion because *time is implicit in the very act of hallucinating time*. Hence time — or more precisely, the phenomena of temporal flux and happening — cannot be entirely unreal.

Thus the apparent flow of time cannot be entirely a byproduct of structural features of a fluxless, happening-free world. Time's flow, as we perceive it, cannot emerge from an entirely fluxless substratum. The transitionality of time is an objective feature of the world. This does not imply that time has an extramental origin; I have not ruled out the possibility that flux or happening is a product of mental phenomena. (Note also that my argument for the reality of transitionality showed that flux and happening are real in *subjective* time. The argument also will work for clock time, if the clock goes forward in the usual manner while subjective time progresses.) But even if these temporal features of the world were psychological in character, *they*

still would be objectively real.

We have taken an important step along the path from experience to world. We have shown, using facts about how things seem, that *experiences happen.* We also have shown that events which exist for observers happen (if those events are real), and that objects which exist for observers are in temporal flux (if those objects really exist). In short, we have passed from how things seem to the *reality of time's flow*. Along the way, we have shed some light on the real nature of that flow.

Besides establishing the reality of time's flow, the above argument shows that time has a unique epistemic status among all the general features of the world. It shows that one cannot apply the method of Cartesian doubt to time as one might apply it to material objects. Attempts to doubt the reality of time as Descartes doubted that of the material world can lead a skeptic only to the certainty that time — in some form, either subjective or objective — is real.

From Consciousness to Objective Time

The conclusion that experiences exemplify happening has two important consequences.

First, it implies that the presence of real happening in the world is a necessary consequence of the existence of subject histories of a certain sort. If there is a subject history which has more than one consciousness event, and a temporally extended event exists for a string of consecutive

consciousness events in that history, then there really are events which happen, at least along the subjective time coordinates of observers. In short, *a world containing consciousness like ours is a world in which there is time of some sort.* There is no need to look further than consciousness to explain why time is a feature of reality.

Secondly, we now know that any conscious being which has more than one consciousness event in its history *really lives through time of some kind.* This is the subjective time dimension whose moments or "points" are the subject's consciousness events. Subjective time is characterized by a kind of transitionality, and therefore really is a variety of time.

A world containing experiences of the sorts with which we are familiar has to be a world in which time is objectively real. The reality of such experiences is a sufficient condition for the reality of happening, and therefore for the reality of time in its broadest sense. (This does not mean that the existence of consciousness implies the existence of time as physics knows it, with all of its ordering and metrical properties. It means only that the existence of a consciousness event with a successor is sufficient for the existence of bare happening, which is the most central feature of time.)

These results also serve to clarify the logical connections between mental concepts and temporal concepts. Although philosophers long have noticed that there are such connections, the nature and extent of those ties remains largely mysterious.[38] In this chapter I argued that any real

objects which we perceive as happening or in flux in subjective time really are happening or in flux. Thus, objective temporality is a facet of any world in which conscious observation occurs. This connection between consciousness and objective temporality is a consequence of the nature of the peculiar mental circumstances which give rise to subject histories. Roughly speaking, a prolonged event of observing or experiencing a persisting subject must have parts which "give way" to other parts in a way that constitutes happening.

This kinship between consciousness and temporal flux implies that any conscious being has objective temporal properties. Such a being can be said to exist in time, provided we do not mean by this a form of time closely resembling the physical time with which we are familiar. The experiences in the history of a conscious subject really happen. Even if this happening is only happening in subjective time, it still is objectively real. If the subject's subjective time runs in the same direction as physical time (recall Chapter 5), then there is happening in physical time as well.

Thus, there is no such thing as a conscious being free from all flux, duration, becoming, or happening. It is the nature of a conscious being to live in some form of time, just as it is the nature of a garden snail to live in a shell.

Chapter 8

The Experience of Time

In the last chapter I discussed the problem of the nature of time's flow and touched upon the problem of the reality of tense.[1] In this chapter I will explore some logical connections between the concept of consciousness and the concept of tense. The results of this exploration will shed some light upon the more general issue of the connections between mental concepts and temporal ones. Some people regard such connections as forming a significant puzzle in the philosophy of time.[2]

The tensed view of time is what I previously called the *A* series view — that is, the doctrine that events really do have tenses, such as past, present, and future, instead of merely seeming to us to have tenses. It is closely allied to the commonsense view that time is moving toward the future. Some philosophers have regarded the tensed view of time as logically untenable.[3] My main contention in this chapter is that the tensed view of time is consistent and true when understood as a thesis about *subjective* time. More

precisely, the main points of the tensed view come out true and consistent if one assumes that tenses are properties defined *relative to consciousness events,* rather than being absolute or objective properties of events. I will show that the picture of time typical of *A* series theories is right in many of its points, provided that we treat tense as a subjective property in this way. For example, relative to a single consciousness event, future events do not exist while present and immediately past ones do. Overall, I aim to show that the tensed view of time is a correct way of thinking about subjective time, even if it is false when applied to objective time. Tense is a real feature of subjective time.

The material in this chapter consists in part of technical details; because of the nature of the arguments I will use, there is no way to avoid this. The details of the arguments will be of interest mainly to those interested in the philosophy of time. However, the general conclusions reached here will be used occasionally later on. Those who wish to skip the details of the arguments can do so, though this may, of course, make the reasons for the conclusions less clear.

Subjective Tenses

In the last chapter I mentioned *A* and *B* series theories of time. According to *A* series theories, tense is real; it is a feature which times or events objectively possess.

According to *B* series theories, tense is not real, although it may appear to us to be real and may, in a certain manner, even have practical importance.[4] *A* series theorists typically hold that events really change from being future to being present to being past. *B* series theorists typically attempt to reduce the so-called movement of time to the ordering and other properties of the *B* series of times or events. The *B* series viewpoint entails that all events, whether they are labeled past, present, or future, are tenselessly real.

One limitation of *B* series theories is their difficulty in giving a proper account of the ephemerality of events. In Chapter 7 I showed how to overcome this limitation. To some people, the tenseless view of time seems to make it difficult to justify our normal emotional feelings about the future and the past. In Chapter 7 I alluded to this difficulty; here I will discuss it in greater detail, and will show how it can be overcome.

The hypothesis of the reality of tense is beset by logical difficulties. Mellor has argued (successfully, I think) that these difficulties rule out the objective reality of tenses.[5] Yet as Mellor has noted, tense plays an important role in human psychological life. Everyone knows that we experience the passage of future events into presence, and that we live through the seemingly irreversible slipping away of the present into the past. Mellor's explanation for the psychological role of time's apparent passage depends on his "token-reflexive" theory of the semantics of tensed beliefs. On his account, tensed beliefs may be true (and cannot be replaced entirely by tenseless beliefs) even though

there are no objective tenses.[6] Mellor has noted the important fact that tensed belief is a practical necessity for human action.[7]

Within the subjective time order on a subject history, any consciousness event is either past, present, or future to any other. At any subjective moment in the history of a subject besides the first and last consciousness events (if these exist), there is a series of past consciousness events of that subject stretching out into the subjective past, and there is a series of future consciousness events of that subject stretching out into the subjective future. One can use these consciousness events to define a series of tenses for the subject's history, just as an *A* series theorist uses past, present, and future events to define the *A* series.

Consider a single consciousness event, E. If a fact is the case for some consciousness event in the subjective past of E, we will say that that fact is *subjectively past* at E. If a fact is the case for some consciousness event that is in the subjective future of E, we will say that that fact is *subjectively future* at E. If a fact is the case for E, we will say that it is *subjectively present* at E. In this way, we define three subjective tenses: the subjective past, present, and future.

We may also speak of a thing or event which is not a consciousness event as being subjectively past, present, or future for a consciousness event x, if the fact that that entity exists is subjectively past, present, or future for x.

Tense logicians know that phrases indicating tense, like

"is past" and "is future," can be treated as operators on sentences.[8] The above definitions could be used in a straightforward way to define operators for subjective pastness, presentness, and futurity, analogous to the usual tense logical operators for the past and future tenses.

These *subjective tenses* capture certain everyday intuitions about the tenses of experienced events. They reflect a subject's living experience of time. It is a fact of everyday experience that some things, situations, and events seem to be present and that others once seemed to be present; we believe that still others will seem to be present. One really does live through the passage of one's experiences from presentness to pastness. The above definitions of the subjective tenses describe the past, present, and future as we feel them in our experience.

Note that the subjective tenses as defined here are not just *apparent* properties of facts, events, and things. They are not merely properties that these items *seem* to have. There are facts which are subjectively past to you now, but are such that it does not seem to be the case that those facts once were true. (These include facts about events which you really lived through, but which you no longer remember.) There also are facts which seem to you to have been the case, but which are not subjectively past for you now. (These include imperfectly recalled memories.) Analogous remarks can be made for the subjective future tenses. The subjective tenses reflect the real flow of experience which occurs as consciousness passes from one subjective moment to another. They need not reflect the way things seem now.

We could, if we wanted to, define other tenses corresponding to the way things seem now. We could call these *apparent* tenses.[9] A fact is *apparently past* at a consciousness event if and only if for that event, it is true that that fact once was the case. Similarly, a fact is *apparently future* at a consciousness event if and only if for that consciousness event, it is true that the fact will be the case, and a fact is *apparently present* at a consciousness event if and only if for that consciousness event, the fact is the case. The apparent tenses can be thought of as tenses which are apparent *in the subjective world* — features of the realm of appearance of a consciousness event. The subjective tenses, in contrast, are features of facts and things in the subjective world, but are not necessarily present in the subjective world themselves. They need not always be part of the way things seem now.

For the remainder of this chapter I will concentrate on *subjective* rather than *apparent* tenses. The subjective tenses reflect the real temporal order of subjective life. Some of what will be said carries over to apparent tenses as well.

Mellor's and McTaggart's critiques of tense suggest that no event is objectively past, present, or future.[10] But their arguments cannot be used to derive a contradiction from the *subjective* reality of tenses. If one replaces the tensed sentences in Mellor's argument against tense with the corresponding subjective tenses relative to some consciousness event, one finds that the revised argument will not go through. The relativization of tenses to different

consciousness events forestalls any contradiction.

By dividing subjective tenses more finely than we have done, one can in principle define a *subjective A series* of subjective tenses. If tenses turn out not to be real, then none of the tenses in the ordinary A series is exemplified objectively; that is, it is the case objectively that no entity has any of these tenses. However, this statement does not carry over to the subjective *A* series. The subjective tenses are properties which are defined in terms of moments of conscious life. They are not properties which an event can have in an absolute (non-relative) way. (Since the subjective tenses are not apparent tenses, an entity which possesses one of them at a consciousness event might not even possess it *for* that consciousness event.)

Subjective Tense and Subjective Ontology

Many people feel that past events already are over and done with, and that future events do not yet exist. This view is incorrect if there are no objective tenses, yet it is intuitively plausible. As I experience the passage of time, future events become present, and really do come into being for all practical purposes. As I act, I feel that I am creating events, making them happen, not just unearthing them from a temporarily inaccessible realm of future events that already exist. Even if I begin to believe that I do not really create events, still I am likely to suspect that causes bring their effects into being. I may believe intellectually that past,

present, and future events are equally real, yet I still may feel that new events are created as time passes.

The intuitive view that future events become present and thereby come into being is wrong if taken as a belief about the objective being (that is, the actual existence) of events. However, it is quite true if taken as a statement about the *subjective* existence of events. Given a subjective moment (that is, consciousness event) x in a subject's history, events in the subjective future of x do not exist for the subject's current consciousness event x. Events in the immediate past of x do exist for x. Events in the more distant subjective past of x do not exist for x, but they are connected to x via a chain of consciousness events of a specific sort: any such distant past event exists for a consciousness event, which exists for a consciousness event, which ... which exists for x. Such distant past events do not exist for x, but can be said *to have existed* from the standpoint of x. Hence the naive picture of events coming into being as time passes is correct, with few qualifications, if by "time" and "being" one means *subjective* time and *subjective* being.

The intuition that the present situation brings future situations into being also turns out to be at least partially accurate when applied to subjective time and subjective being. In particular, each consciousness event in a subject history stands in a relationship to its successor which is somewhat like the relation of causation. This is the relationship by which one event "gives way" to another; I discussed this relation in earlier chapters. Although this relationship may

not strictly be a causal relationship, it resembles a causal relationship in some respects.

These considerations suggest that Mellor's ideas about the psychological function of tense, even if largely right, do not give tense a sufficiently high place in mental life. Tense is not merely an indispensable feature of statements and beliefs; it also is a feature of the apparent facts, things, and events which exist for consciousness events. The possibility that there are no objectively real tenses does not change this. Tense is a paradigmatically subjective temporal notion.

The reality of tense *relative to consciousness* should put to rest any unease one might have about the grounding in a tenseless world of normal human attitudes towards the past and the future. So far as conscious life is concerned, the world is not tenseless at all.

Temporal Modalities: A Technical Note

I will close this chapter by indicating how an account of the notion of *truth at a time* might be extracted from the theory of subjective time developed above. I will sketch the beginnings of an account of truth at a time which seems to avoid certain pitfalls characteristic of tenseless accounts of this notion.

Intuitively, a statement can be true or false at a time. Even so simple a sentence as "The dog is black" can be thought of as having different truth values at different times. The subject of tense logic[11] is grounded on this recognition;

in it, tensed statements are analyzed into tenseless statements plus phrases indicating tense. For example, "The dog is black now" obviously may be rewritten "It is now the case that the dog is black"; "The dog will be black" may be rewritten "It will be the case that the dog is black," and "The dog was black" may be rewritten "It was the case that the dog is black." Standard tense logics use this sort of analysis of tensed statements. The alphabets of these logics contain modal operators which serve as formal equivalents of "It will be the case that" and "It was the case that".[12] These operators can be affixed to statements, tenseless or tensed, to form new statements. There is a standard semantics for tense logic.[13] This semantics is analogous to the possible worlds semantics for other modal systems, with times or instants playing the role of possible worlds.[14] For example, if P is a well-formed formula of tense logic, then given a model for the tense logic and a time t in that model, the formal equivalent of "It was the case that P" is true at t if and only if P is true at some time u in the model which is earlier than t in the time order relation of the model.[15]

Mellor has proposed a treatment of unary properties of things as relations between things and times.[16] According to Mellor's account, subject-predicate sentences which normally are taken to express the instantiation of a property by an object, and which may be true or false at a time, can be taken to express the instantiation of a relation by an object and a time. On this view, "The cat is black" has essentially the same meaning as "The cat has B to t," where

B is a relation (of blackness at a time) and t is a time or date (the time at which the sentence is uttered).

Intuitively, there is a problem with this account: some people find it hard to believe that black is a relation whose field contains *times or dates*.[17] This sense of disbelief is especially strong with regard to perceptible qualities like colors. One may find it implausible that colors are not exemplified by colored objects alone, but by colored objects together with *dates*, of all things.

The theory of subjective time which I proposed in Chapter 5 suggests a way to get a more natural account of truth at a subjective time, at least for some statements. Moments of subjective time exhibit some of the possible-world-like character which temporal logic imputes to times. They have this character because they are consciousness events, and hence can endorse statements as can possible worlds (recall Chapter 3). A sentence can be true or false at a subjective moment because a sentence can be true or false for a consciousness event. Thus there is a natural sense in which a sentence (or proposition) can be said to be true at a time, provided that one is speaking of moments of subjective time in a subject history and not of times of some other sort. The modal, worldlike character of consciousness events leaves room for an account of time-dependent truth which does not have the counterintuitive character of the *B* series-based recasting of properties as relations. On an account of this sort, "The cat is black" is true at subjective time t and false at subjective time u if and only if for t the cat is black and for u the cat is not black.

This sketch of an account of truth at a time can be extended to other sets of times besides subjective histories; in a moment I will show how this can be done. But the sketch as it stands already is helpful. It suggests how we might account for the truth at a subjective time of subject-predicate statements whose predicates refer to perceptible qualities. These are precisely the cases of truth at a time for which the replacement of properties by relations to times conflicts the most strongly with intuition.

As it stands, the account suggested here can give "The cat is black" a truth value at t only if t is a subjective moment involving experience of the cat. But this truth gap should not be surprising. For a consciousness event not involving experience of the cat, the cat does not exist. Therefore, the problem of filling this truth gap is simply the known problem of assigning truth values to statements containing nondenoting terms.[18] There also are cases in which the cat exists but has no color at x — for example, if the noticing subject is blind and feels the cat. In these cases, the cat exists for x, but the cat cannot have any color at x.

We should be able to extend this account of truth at a time to physical times (that is, the times measured by clocks). Since I have not analyzed the notion of a physical time or of physical simultaneity here, I will not make this extension explicitly. Instead I will merely indicate how it might be done.

We could say that "The cat is black" (P) is true at a physical time t for a subject S if and only if S's history contains some consciousness event x which takes place at t and is such that

P is the case for x. To complete this definition we would have to specify a simultaneity relation connecting consciousness events with physical events. If consciousness events are events that happen to brains, this is not a big difficulty. It seems reasonable to accept an analysis of perceptible-quality predications like "x is black" which makes this statement objectively true if and only if an observer under certain standard conditions would see x as black. Having done this, we can give conditions for the truth of "x is black" at a physical time t in terms of that statement's truth for observers at time t. Using the above analysis of truth for an observer (subject) at t, we can write the truth conditions for the statement at a physical time in terms of its truth for consciousness events.

The preceding account of truth at a time suggests that an object truly can have a perceptible quality at a time. There is no need to convert perceptible qualities into relations between objects and times. Subjective time, and probably physical time as well, inherit their intensional characteristics from consciousness events, which are worldlike.

Chapter 9

Spacetime and Happening

In Chapter 7 I presented a new view of time's flow. I argued that the flow of time is an objectively real feature of the universe, but that it arises from an intrinsic "flowing" character of things and events instead of from a real movement of time. In this chapter I will discuss the implications of this dynamic picture of time for the scientific conception of spacetime. During this discussion, I will begin to present the new view of reality which I promised in Chapter 1. Although I will not unveil this view in its entirety until later, I will establish some of its main points here.

The special and general theories of relativity suggest that time is a dimension of the physical world, analogous to the three dimensions of space and sharing most of the properties of space. There is a widespread feeling that this "spatialized" view of time is incompatible with the belief that time's flow is real. I will begin this chapter by arguing that this feeling is quite mistaken. Mellor has argued that

relativistic physics does not compel us to adopt a thoroughly spatialized view of time[1], but here I will do more. I will use the ideas about time developed in earlier chapters to reconcile the existence of real temporal flux with the view of physical time suggested by relativity.

The Timeless Happening of Events

In earlier chapters I suggested (following McTaggart and Mellor) that there are no objective tenses. The objective unreality of tense implies, among other conclusions, that all events are equally real. Events do not begin to exist when they become present for us, nor do they cease to exist when they become past for us. They exist in a tenseless manner; they do not have to be present to exist.

Anything that fails to be a happening entity also fails to be an event. The one possible exception to this rule is an instantaneous event (recall Chapter 7). A non-instantaneous event has the property of happening. But past, present and future events all are equally real. Since all of them equally are events, all of them possess happening. In other words, every event — whether past, present, or future for us — *happens.* Every event that has happened, is happening, or will happen can be said *to happen* in a tenseless sense. Of course, not all of these events are happening now; when we say that an event is "happening now," we normally mean that it is present. But if events exist tenselessly and each event exemplifies happening, then we are forced to conclude

that all events happen, regardless of their supposed tense.

A similar conclusion holds for the temporal flux of persistent objects. Everything which persists through someone's subjective time is in flux tenselessly. The fact that someone correctly labels that thing as a "past," "present," or "future" object relative to some time does not change this.

All events happen tenselessly and all persisting things endure tenselessly. If events and things are embedded in a spacetime as physicists postulate, then all the contents of that spacetime possess duration or happening. In other words, *the spatiotemporal world as a whole perpetually endures*.[2] Its contents perpetually happen, perpetually flow. The fact that the world as a whole does not move from the past toward the future is irrelevant to this conclusion. If an event happened in 1900, then it is true now that tenselessly speaking, that event *is happening*. If a physical object existed in 1900, then it still is true now that that object *endures* in a timeless way — that it tenselessly *is* in temporal flux.

When speaking in this way, one must be very careful to distinguish between tenseless existence and happening on the one hand, and existence and happening in the present on the other. The possibility of confusions like this was known to McTaggart, who recognized that confusing such ideas or phrases can lead quickly to absurdities. The following example, though not McTaggart's, embodies his thinking on this topic; my subsequent claim about the source of the confusion is essentially his.[3] If the last battle of World War

II happened in 1945, then it is the case now that that battle *happens*, for it is an event and events tenselessly happen regardless of what date is now present. But it goes without saying that that battle is not now a present event. The sentence "The battle is happening now" normally means that the battle happens and is present. But we also know that now (and at any other time), it is tenselessly true that the battle happens. Confusion between these two kinds of "present" happening can lead to brazen absurdities like this: the battle happened in 1945; but everything that ever happened happens tenselessly; therefore, the battle is happening now, so it is a present event. The mistake here is confusion between the idea that the battle is happening tenselessly (so that now it is the case that it is happening tenselessly) and the idea that the battle is located at the present date (so that now it is the case that it is a current event). The use of phrases like "now the battle is happening" can lead us into this confusion. We must be exceedingly careful to avoid this kind of confusion if we think that events which are not present may still be items that happen.

Since every event in spacetime tenselessly happens, it follows that the entire history of the physical universe tenselessly happens. Spacetime as a whole has the feature of happening. The following example — which is not to be taken as anything more than science fiction of the most venturesome sort — illustrates what this means. It suggests a way to think about the timeless happening of events — and a new way to think about the concept of spacetime.

Suppose that one somehow could get outside of spacetime and observe spacetime as a whole — including all times at once — from a vantage point outside of spacetime. Suppose, for instance, that there were another universe, of the sort which physicists speculate about today.[4] Further suppose that someone in that universe somehow managed to observe our entire spacetime, or some large region therein, from the outside. If the standard physical conception of spacetime (or any reasonably close variant of it) is correct, then the external observer would see a four-dimensional world containing events. (Some current physical theories use a world with more than four dimensions,[5] but this does not affect the argument as long as there is a dimension of time.) Ordinary motions, and the histories of objects which persist through physical time, would appear as paths (worldlines) having extension in the time direction. But aside from these motions and histories, which would appear as paths rather than as motions, our observer might notice the spatiotemporal world itself happening, with its contents giving way to further states of themselves. If the observer could detect the property of happening, then the observer could see the world, including all times, going on and on and on. One would see this because the contents of spacetime *happen*. This happening of the contents of spacetime is a temporal phenomenon in a broad sense. It is, so to speak, a persisting of spacetime itself through time of some sort. However, it is not a *motion* which can be represented by a series of states in time and summed up by a worldline in spacetime. (Of course, one cannot take this

metaphor of persistence too literally, since spacetime is not occupying successive moments of time — but more on *that* possibility later.)

This picture of a timelessly happening spatiotemporal world suggests that the conceptual gulf between the concept of happening and that of the *B* series is rather wide. The *B* series of dates, as measured by any given clock, lies within spacetime. Ultimately its dates are just positions along some time axis (or reference worldline) within spacetime. Items could have dates in that series even if there were no happening. A geometric structure similar to spacetime, but with happeningless four-dimensional bodies replacing events, would still have a fourth coordinate; hence points in it could be given dates, and a *B* series could be defined. But in the real world, in addition to the coordinate or direction in spacetime ordinarily called "time," there is *another aspect of time* which is neither a direction nor directly reducible to spacetime's geometry. This is the time in which the spatiotemporal world might be said metaphorically to move. This aspect of time is *happening*, an objective feature of the spatiotemporal world.

Global Happening and Super-time

Some philosophers have taken seriously the equation of temporal flux with a motion of spacetime. Broad once mentioned and rejected the possibility that the present moment travels forward through time as it seems to do.

Such a movement, Broad realized, would have to happen in a dimension of time other than the time dimension currently known to physics.[6] George N. Schlesinger has called this hypothetical extra dimension of time "super-time."[7] My conclusion about the timeless happening of spacetime does not require an extra time dimension, though it certainly does not rule out the existence of such a dimension. I will make no use of the idea of an extra dimension here. Nevertheless, the pure happening of the universe which I portrayed above might be regarded as a "non-metrical super-time" — a form of temporality within which the flow of ordinary time occurs, but which cannot be regarded as a dimension or as extended, and cannot be measured or quantitated by means of a time coordinate.

Broad rejected a super-time interpretation of time's flow because it threatened to lead to an infinite regress:[8] if one tries to explain the flow of time as a motion which takes place in super-time, then one still must explain the flow of super-time; that explanation demands a super-super-time, and so forth. But a non-metrical notion of super-time can block this regress. I have argued that there is a sort of temporal flow which is not reducible to movement through a series of times. This flow is not associated with changes in a time coordinate; an object can participate in this flow without going through successive instants of time (or, for that matter, of super-time). To stop the regress of super-times, one need only regard one of the supposed extra time dimensions — super-time, super-super-time, and so forth —

as forms of non-metrical temporality of this sort instead of as a new quasi-spatial direction. If one regards spacetime's "motion" as non-metrical temporality in this way, then there is no need to postulate a super-super-time in which this movement occurs. The flow of non-metrical "super-time" cannot be conceived of as a movement in a super-time direction or down a super-time axis. There is no direction associated with such a "super-time." (Of course, one can end the regress at a later stage if one thinks, for some reason, that there are extra time dimensions.)

Non-metrical "super-time" of this sort is simply the timeless happening of the contents of spacetime. The view that everything in spacetime timelessly happens may be regarded as a refinement and relativization of the super-time theory. This new view postulates a kind of time beyond the time we ordinarily measure, but it does not postulate extra geometric dimensions of time as the super-time theory does. (Such extra dimensions may or may not exist, but their existence is neither necessary nor sufficient for explaining the fact of time's flow.) The view that spacetime tenselessly happens is analogous to the super-time theory in some respects but differs from it in other crucial ways. Both ideas postulate a temporal aspect of reality above and beyond the time dimension known to physics, but according to the non-metrical view, this aspect is not an extra dimension of time. Instead it is a non-geometric feature of the world — what I have called tenseless happening.

Subjective Flux Is an Aspect of Tenseless Happening

In Chapter 8 I argued that tense and changes in tense exist relative to consciousness events. Now we find that subjective changes in tense are part and parcel of the tenseless happening of the spatiotemporal world as a whole. Subjective changes in tense accompany the occurrence of experiences. The fact that experiences happen ultimately is an instance of the tenseless happening of events. Hence the perceived flow of time (change of viewpoint along the stream of consciousness) can be thought of as an aspect of the real tenseless duration of the world.[9]

Everyday experience reveals that subjective time passes as physical time passes. Both forms of time "flow" in the same direction. The above remarks on subjective time suggest that this empirical conclusion may not be logically necessary, or at least does not follow from the definitions involved. (Whether it is required by physical laws is a separate question which I will not take up here.) The subjective movement of time depends upon the tenseless happening of the consciousness events in a subject history. However, it does not require those consciousness events to be situated in any particular way in *physical* time. The experience of time's flow does not appear to depend logically upon the orientation of the subject history in spacetime. Probably it is not logically necessary that the

string of consciousness events which make up a subject history lie along what physicists call a timelike path, with the subjective successor of each event lying in the physical future of its predecessor. For subjects like us whose subject histories do happen to lie this way, the subject's viewpoint will move in a timelike direction on a path in spacetime as tenseless happening proceeds. For us, subjective time runs together with clock time, and to endure is to have some physical time pass. Yet despite this contingent connection between physical and subjective time, these two forms of time are logically distinct. Happening, which grounds subjective changes of tense, is a feature of spacetime as a whole and also is an inherent property of individual events. Physical time is a set of directions in spacetime, described by coordinates defined on spacetime with the help of clocks.

Minkowski versus Bergson: A Peace Proposal

Bergson is the philosopher best known for drawing the distinction between physical time and temporal flux.[10] He portrayed time as primarily "duration," a qualitative, non-metrical principle which pervades experience but is ignored in scientific analyses of time. On Bergson's view, the physical and mathematical analysis of motion tends to lead to the false conclusion that time is simply a series of moments analogous to the points of space.[11] Quite different from Bergson's view is the standard interpretation of special relativity, primarily due to Minkowski.[12] On the latter view,

time is a dimension, or type of extension, rather closely analogous to space.[13] People often feel that these two views of time are incompatible. Even if relativity theory does not strictly force one to believe that time consists simply of a series of time-positions or like items, it certainly makes such a view tempting.

The conflict between special relativity and the Bergsonian view of duration is real only if the Bergsonian position implies that time is solely a non-metrical principle, instead of a "spatialized," Minkowskian series of moments. (This would be the case if, for example, the physical universe were three-dimensional and contained objects which endure in Bergson's sense.) But the Bergsonian view of time as duration need not contradict the scientific view that time is a dimension of the world. The Bergsonian view still can hold if there can be duration *in addition to* a geometric dimension of physical time — that is, if the world is a four-dimensional spacetime in which real duration plays some role.

Bergson's own views, pushed to their logical conclusion, appear to imply something like this combined view. Bergson held that time is *cumulative* — that the past is contained in the present in a certain fashion.[14] But if the past is contained in the present and the present really endures, then what really endures is the past and present together. If one takes seriously Bergson's ideas of duration and of the accumulation of the past in the present, then one is compelled to conclude that both the past and the present endure. Bergson also seems to have held that the present contains the future, though perhaps only as

"potentialities."[15] If its claims about the cumulativity of the past and the potentiality of the future are taken at face value, then Bergsonianism issues in the view that past, present, and future all endure as the present endures. In other words, Bergson's view of time implies that *it is spacetime or the spatiotemporal world which really endures*.[16] This consequence agrees with my conclusion that the spatiotemporal world as a whole exemplifies happening. Such a view of spacetime reconciles the reality of spacetime with the reality of pure flux.

Notes

Bibliographical references, cited here by author and year, can be found in the "Works Cited" section of the book. Numbers following such citations are page numbers unless otherwise indicated.

Chapter 5. Conscious Beings and Their Histories

1. For background information and ideas about this problem, see for example Shoemaker and Swinburne 1989 and Hirsch 1982 (especially Ch. 10). For my understanding of this problem earlier in my career (though not for my position on it), I owe much to Shoemaker and Swinburne 1989 particularly.

2. This example is adapted from Shoemaker 1989, 86. I will discuss an example like this more thoroughly below.

3. For discussions (favorable, unfavorable, or otherwise) of such theories, see for example Carruthers 1986, 76-82; Grice 1941; Shoemaker 1970; Swinburne 1989, 8-13; Shoemaker 1989, 77-88; Hume 1739-40, Book I, Part IV, Section VI (pp. 261-262). The term "quasi-memory" is used especially in Shoemaker 1970 (272, 271 and elsewhere). Shoemaker 1989 (77-82) and Swinburne 1989 (8-11), among other authors, discuss a classic theory of this sort due

to Locke. Grice (1941, 342) discusses and rejects a view on which a kind of remembering of a state just before the present one establishes personal identity. The role of *immediately preceding experience* in this view matches that in the theory I am going to propose. The account at which Grice finally arrives in Grice 1941 is quite different from my account.

4. James 1884, 146. There are similarities between James' view of the stream of consciousness and the view I will present here. In particular, James noted that "earlier segments [of the stream] become objects for the later" (James 1884, 167, footnote). He entertained, but rejected, the view that this kind of unity of the stream simply *is* the ego (James 1884, 167, footnote); he attributed to some Hegelians a view rather similar to this view he rejected (James 1884, 149, footnote).

5. For remarks on personal identity after memory loss, see Swinburne 1989, 24-25 and Shoemaker 1989, 86-88.

6. James 1884 (though James' aim there was not to solve the problem of personal identity).

7. Foster 1979.

8. Shoemaker 1989, 86-87. For other relevant remarks on total amnesia, see Swinburne 1989, 24-25.

9. The example here is based on one from Shoemaker (1989, 87-88); I have altered some points and added the conclusion about killing. Green and Wikler (1980, 69) give a similar example, though apparently with a more thorough obliteration of brain characteristics (and with a different philosophical purpose).

10. See Swinburne 1989, 23-25, on personal identity questions about disembodiment, re-embodiment, and survival of death. On p. 25, Swinburne discusses the question of personal survival without memory.

11. *Ibid.*

12. Time as experienced by the subject of consciousness has been studied by Foster (Foster 1979, 175-176) and by Russell (Russell, 1948, 210-217), among others. Russell uses the terms "subjective time" and "objective time" (Russell 1948, 212), and refers elsewhere to "a public and a private time" (Russell 1912, 32). My ideas on the topic differ from these authors' ideas in crucial ways, though, as I have pointed out elsewhere, I owe intellectual debts to each.

13. Shoemaker 1989a, 145-147. See also Shoemaker 1989, 130-132.

14. Shoemaker 1989, 130.

15. Hirsch 1982, 286-301.

16. In Foster 1979. The quote is from p. 177.

17. The items unified into a subject history are quite different (consciousness events on my view, "presentations" on Foster's (1979, 175)), as are the relations which unify those items (continuance on my view, instead of Foster's "double overlap" (176)). My account of the subject also resembles Russell's and Carnap's views in certain respects (see chapters 1 and 3 in the present book, as well as note 32 to this chapter).

18. Relevant experiments and ideas are discussed in Dennett 1991, 114-115, 139-170.

19. See Dennett 1991, 119, 125.

20. Locke 1689, Book 2, Chap. 27 (p. 336).

21. Foster 1979, 182.

22. James 1884; the phrase itself is used on p. 146. (I should mention that James' aim in that essay was not to solve the problem of personal identity.)

23. On some psychological aspects of time, see for example Krech, Crutchfield and Livson 1969, 98, 228-229.

24. Dennett 1991, 113; see also 111-112, 253-254.

25. Dennett 1991, 111. The model is discussed in Dennett 1991.

26. Dennett 1991; particularly 135, 144, 166, 407; "'presentations'," 169 (see also 107).

27. Dennett 1991, 356.

28. Dennett 1991, 96-97.

29. Leibniz 17xx, paragraph 21 (p. 151). See also Leibniz 17xx, paragraphs 19-20 and 22-24 (pp. 150-151), and the modern commentary of Schrecker 1965, xv.

30. For example, Church 1956 and Drake 1974.

31. Mereology (the formal theory of wholes and parts) is discussed in an accessible way, in the context of the philosophy of mathematics, in Lewis 1991 (see especially pp. 1-3 and 72-74).

32. The logical constructions used by Russell (see for example Russell 1918, especially 143-146, and Russell 1924, 163-166) and Carnap (Carnap 1928, especially secs. 132, 136, 163) were, in my view, such substitutes. Russell's and Carnap's accounts of the self are different in central respects from mine. According to their accounts, the history of the self is a class of experiences (taken to be entities)

unified by a relation which can involve long-term memory (see Russell 1918, 148-150; Carnap 1928, pars. 78 (pp. 127-128), 108 (pp. 178-179), 120 (pp. 188-189), 132 (pp. 203-205)).

33. For a general discussion of the topology of time, covering some of the properties mentioned here, see Newton-Smith 1980, 48-54.

34. On closed time see for example Newton-Smith 1980, 57-65.

Chapter 7. The Flow of Time

1. One exemplar of the general trend of thought known as "process philosophy" is Henri Bergson, whom I will discuss shortly. The general line of thought in this chapter (aside from cited sources) owes much to Bergson 1907, although the model of time at which I finally arrive will be different. One need not accept Bergson's ideas about biology to appreciate and accept many of his ideas about time.

2. See for example McTaggart 1927, Ch. 33, pars. 333 (pp. 22-23) and 342-350 (pp. 27-31), and Mellor 1981.

3. See Bergson 1907, especially 1-9, 336-342.

4. Bergson (1907, 4) speaks of a "progress of the past which gnaws into the future."

5. Bergson 1907, 2.

6. Mellor uses the terminology of "thing-stages" in Mellor 1981, 127.

7. But see Bergson (1907, 2) for a contrasting remark on change.

8. See Bergson 1907, especially 1-9, 336-342.

9. The terminology of "object-stages" is used by Hirsch (1982; see for example 4).

10. See notes 3 and 4 above for Bergson's original version of this thought.

11. On this flow, see for example Mellor 1981, 7, 168-170, 116-118.

12. Mellor 1981, especially 7, 10, 168-170, 116-118.

13. The adjective "transitional" occurs in Whitrow 1973, (168, 175-177).

14. Richard Swinburne (Swinburne 1989, 43) makes nearly the same point when he points out that the time ordering of consecutive experiences can be "a datum of experience." This idea is implicit in Foster's view of subject identity (Foster 1979, 175-176); indeed, Swinburne (1989, 43) cites Foster as a source of his argument for this claim. Foster acknowledges that one can "directly see the movement" of a thing in motion (Foster 1979, 176).

15. See Pfeiffer et al. 1964, 163, which contains a dramatic illustration concerning frog vision.

16. Broad proposed the analogous idea that "sensible motion" implies, but is not reducible to, the succession of

apparent positions (see Broad 1927, 412). Russell (1948, 210-211) realized that motion may be noticed in one mental grasp. According to Foster's account of perception, a single "presentation" may disclose an object's being at two successive spatial positions (Foster 1979, 176).

17. On the uncertainty of time generally, see Merzbacher 1970, 25-26, 31.

18. For physical facts relevant to this phenomenon see Bueche 1986, 150-151, 224. Mellor (1981, 125) has used an example involving centripetal forces and strain in a wheel to make a point about change. However, Mellor's example is used to support a conclusion different from mine.

19. For a brief description of rolling friction, see Bueche 1986, 64.

20. For background on relativistic contraction in general, see Taylor and Wheeler 1966, 64-66; Leighton 1959, 10-11; Bueche 1986, 719-722; Einstein 1955, 34-36. On the de Broglie wavelength generally (and its smallness in the classical limit), see for example Merzbacher 1970, 2-3.

21. For definitions of instantaneous velocity and linear momentum, see e.g. Bueche 1986, 36-37, 109.

22. On these or other 4-vector quantities see Taylor and Wheeler 1966, 111-112; Leighton 1959, 28, 32-34; Einstein 1955, 44-46.

23. Bergson contrasts "a movement" with "rests placed beside rests" (1907, 312), and denies "that movement is made of immobilities" (308). See also 305-314, 336-338.

24. See note 16 above for possibly related ideas, due to Broad, Foster and Russell, about the *experience* of motion.

25. See for example Taylor and Wheeler 1966, 19.
26. Mellor 1981, 127.
27. McTaggart 1927, Ch. 33; Mellor 1981, Ch. 6.
28. For discussion and critique of this and related ideas, see Mellor 1981, especially 116, 168-170.
29. McTaggart 1927, Ch. 33; Mellor 1981, Ch. 6.
30. See Mellor 1981, 22-23 and 30, for relevant remarks on such views.
31. For a discussion of some ideas of this nature, see Newton-Smith 1980, 126-130.
32. See Mellor 1981, Ch. 6, and McTaggart 1927, Ch. 33 (especially pars. 329-333, pp. 20-23), for discussions of these logical difficulties.
33. See for example Schlesinger 1980, 36, for a passing mention of this metaphor.
34. Russell (1948, 216) proposed that "the time that occurs in the specious present is objective"; this is reminiscent of what I am proposing.
35. Whitrow 1973, 175-177.
36. See Mellor 1981, 150-155.
37. *Ibid.*
38. On connections of this sort, see Newton-Smith 1980, 11-12. For one particular idealistic perspective on these connections, see Howison 1904, especially xiii and 352.

Chapter 8. The Experience of Time

1. On this problem, see for example McTaggart 1927,

Ch. 33, pars. 329-333 (pp. 20-23), and Mellor 1981, Ch. 6. Elsewhere in this book I say more about McTaggart's and Mellor's work.

2. See for example Newton-Smith 1980, 11-12, on this issue.

3. For example, philosophers McTaggart and Mellor (cited above), who have argued that tense is inconsistent.

4. This is recognized in the theory of Mellor (1981, 78-88), for example.

5. See Mellor 1981, Ch. 6.

6. Mellor 1981, 5-6, 73-88, 29-46, 58-59.

7. Mellor 1981, 58-59, 78-88.

8. For a brief introduction to tense logic, see for example Newton-Smith 1980, 52-54, and/or Prior 1957.

9. My distinction between apparent and subjective tense is reminiscent of, though not identical to, Foster's distinction between "phenomenal and presentational time" (Foster 1979, 176; see also 177).

10. On this critique, see the sources cited in note 1 above.

11. On tense logic generally, see for example Prior 1957, especially 8-9; Forbes 1985, 38-40; Newton-Smith 1980, 52-54.

12. These two phrases, and close variants thereof, have been widely used; see, for example, Forbes 1985, 39, and Newton-Smith 1980, 53-54. Prior (1957, 9-10) explains why the phrase "It is the case that" is not similarly useful.

13. See Forbes 1985, 38-43; Newton-Smith 1980, 53-54.

14. See Forbes 1985, 38-39.

15. See Forbes 1985, 40; Newton-Smith 1980, 53-54.

16. Mellor 1981, 111.

17. Mellor (1981, 111-114) offers a rebuttal of essentially this objection. The objection, as described by Mellor, rests on the premise that colors and the like are "non-relational properties, with no more temporal than spatial connotations" (111-112). I am not concerned here with the outcome of Mellor's rebuttal as much as with the remaining intuitive difficulty of identifying properties with relations to times.

18. For an early reference on the interpretation of such terms, see Strawson 1950.

Chapter 9. Spacetime and Happening

1. Mellor 1981, 68-72.

2. Bergson (1907, 11) also noted that "The universe *endures*," and apparently held that the duration of smaller things is inherited from the universe as a whole (1907, 11). But what I have in mind is different; my idea involves *spacetime* as a whole, and requires the tenseless existence of events.

3. McTaggart 1909, 347. McTaggart used the concept of "timeless existence" (1909, 346); this may not be precisely the same idea as that of merely *tenseless* existence. I should mention also that Mellor (see Mellor 1981, for example 14-25) also uses some World War II examples, different from mine and for different purposes.

4. A number of multiple-universe concepts in current physics are discussed in Visser 1995 (4-5, 93, 249-262).

5. I am thinking, of course, of the string theories. There is a large literature, both technical and popular, on these theories. See, for example, Green, Schwarz and Witten 1987 (On higher dimensions in physics, see for example 14-16 and 25 in that reference.)

6. Broad 1927, 59-65. See also Schlesinger 1980, 31-33, 140-141.

7. Schlesinger 1980, 32.

8. Broad 1927, 64-65. Schlesinger (1980, 32) points out a possible way of blocking this regress which is different from the way I am about to present.

9. See note 2 above for a precedent in Bergson.

10. See Bergson 1907.

11. Bergson 1907, 1-10, 305-314, 336-338.

12. Minkowski 1908.

13. See Minkowski 1908, 75-80.

14. Bergson 1907, 4-5, 23. Bergson speaks of "preservation of the past in the present" (1907, 23).

15. Bergson 1907, 179, 181.

16. Bergson actually comes very close to saying this; see Bergson 1907, 11.

Works Cited

(*Note added later:* This list pertains to the entire book, not just to the excerpts.)

This list contains all works used as sources of information or ideas in this book. It is not a comprehensive bibliography of any sort. Many of the topics discussed in this book are subjects of vast bodies of published literature; others, such as introductory physics, are covered in many good books. In cases of these sorts, I concentrated on typical reference sources which I felt would be useful to the reader, or which I personally found helpful. (In areas of active research, these may not be the most current works available.) No slight is intended toward any work not mentioned in this list.

Dates following author's names are meant to be (approximate) publication dates unless a separate publication date is given, in which case they are meant to be (approximate) dates of first publication or creation. The latter dates come from the works themselves or their front matter, or occasionally from Durant 1953. Dates listed in this section should not be treated as exact; some may be educated guesses.

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Mark Sharlow's book *From Brain to Cosmos* was out of print at the time this document was prepared (late 2010). Most of the chapters of *From Brain to Cosmos* appear in the following documents, which may be available online:

"An Introduction to Subjective Facts" (chaps. 2-3)

"Knowledge of How Things Seem to You" (chap. 4)

"Personal Identity and Subjective Time" (chap. 5)

"Subjective Facts and Other Minds" (chap. 6)

"Time and Subjective Facts" (chaps. 5, 7-9)

"Conscious Subjects in Detail" (chaps. 5, 10-12)

"Beyond Physicalism and Idealism" (chap. 13)

"Which Systems Are Conscious?" (chap. 14)

Each of the above documents has "Readings in *From Brain to Cosmos*" as its subtitle and Mark F. Sharlow as its author.

Copies of the printed book may be available through sellers of used books.

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