From A Moment Ago Until Forever:

A critical analysis of metaphysical perspectives on the ontology of time, change and

objects in time

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Richard Pierce Lamb

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Preface

One of the greatest mysteries facing man throughout his intellectual evolution has been the question 'what is time?' The belief in time or at least something very similar to it can be traced back through the centuries of man's existence. It is difficult to say whether or not pre-Greek peoples blindly believed in time without asking the 'how' or 'what' questions, whether or not they critically thought about the issue. For answering these questions about time is certainly elusive. While we have an almost undeniable instinct to believe in time or something like it, time is also one of those facets of reality that we seem incapable of experiencing 'directly'. Physicists tell us that time is a dimension of the universe analogous to the three spatial dimensions, but the spatial dimensions of objects are dimensions we observe daily in the middle-sized object world we populate. That is, we have some sort of 'direct' experience of these three spatial dimensions in almost every waking experience we perceive. The dimension of time, however, has no such direct characteristic. At most we observe these middle-sized, three dimensional objects persisting and we infer from the fact that they remain in existence that they 'persist through time'. Because of this, we assume, time or something like it must be a feature of reality.

From our standpoint in man's intellectual evolution, we have quite strong theoretical reasons for believing in time. For pre-Greek peoples that lacked the support of scientific reasoning, one could probably safely assume that time for them had a religious or spiritual connotation. Time was something the God's created and maintained and it wasn't within man's kin to question time and discover new and interesting facts about time. Perhaps the Greeks were the first to question time from a scientific or philosophical perspective. And it was in their questioning of our concepts of time, change and how objects persist in time that the analysis of these concepts became a profitable venture. As such, critically thinking about time began to show up in many different forms of intellectual activity: science, literature, philosophy, poetry etc. Intellectuals began to wonder what time is and how it exists. Now after centuries of questioning and experiment, we have arrived at some fairly solid and fairly certain concepts in both physics and philosophy as to the analysis of time. This thesis will attempt to present the primary contemporary ideas about time, change and objects in time found in analytic philosophy.

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Abstract

In this thesis we will present and critically analyze four primary metaphysical theories dealing with issues in the ontology of time, change and objects in time: Four-dimensionalism, Three-dimensionalism, Presentism and Fragmentalism. In chapter one, our point of departure will be the 'eternalist' theories' (three and four-dimensionalism) leading motivation: reducing tensed language to relations of earlier than and later than. This chapter will include discussions of Arthur Prior's 'thank goodness that's over argument' as well as other issues with the reduction of tense. This will lead us into a discussion of traditional and refined Four-dimensionalism which will be the focus of chapter two. In this chapter we will also examine one of the best arguments in favor of Four-dimensionalism that purportedly entails Four-dimensionalism. Here we will also look at an objection to Four-dimensionalism coined 'Kripke's disks' as well as a response to the argument that supposedly entails Four-dimensionalism that blocks the entailment. We will then turn to 'Three-dimensionalism' and consider some the issues with rigorously stating the Three-dimensionalist picture. In chapter three, we turn to issues concerned with change. This will involve discussions of McTaggart's self-contradiction argument, the problem of temporary intrinsics, and the puzzle about change and the various responses to it. In this chapter we will also discuss the problem of instantaneous change and consider a way out of it. Our discussion of change will motivate the Presentist thesis, which we will consider in concluding chapter three, as well as objections (the cross-time relation objection, the truth maker objection, and the Special Relativity objection) to it. In chapter four, we will present some of the main points found in Kit Fine's 'Tense and Reality'. Fine will supply four assumptions that provide a new way of considering how the views we've covered break up. The four assumptions will also generate a view we have not yet considered, non-standard relativism, which we will then compare to the type of relativism most Three-dimensionalists assert to solve the puzzle about change. We will conclude the paper by presenting Fine's 'Fragmentalism' and discussing how it handles the issues that have arisen throughout the paper better than any of the other primary theories.

To Lesley & Erin, the two women whose love and support helped me complete this thesis.

Chapter One: Intuitions about Time, Change & Tense

Introduction

Time Without Change

Among many of Einstein's celebrated discoveries, one of his paramount insights was that the four dimensions of the universe are complementary. Contrary to the Newtonian physics preceding Einstein in which space had three spatial dimensions and time was a dimension 'independent' of space, Einstein now asserted that time and space depended upon each other. Time and space, as it were, became integrated on this view. This inference was made after his novel insights into the essential nature of light. We will examine this in more detail later when we look at his Special Theory of Relativity. His idea of the connectedness of space and time, now well evidenced, seems *prima facie* counter-intuitive. The Newtonian conception seems more accurate at first. Our most visceral experiences, our most immediate sense perceptions, speaking loosely, occur in a three-dimensional space. That is, the three spatial dimensions are very apparent to us in our every-day experience. When we examine an appropriately sized object of our experience, we observe its height, width and depth with ease. However, if time is complementary to space, as Einstein thought, one might reasonably think we should observe the dimension of time as easily as space. This lack of a posteriori evidence might have partly been what led Newton to believe time was something separate from space and hence why Einstein's assertion seems counter-intuitive.

Given that time, which is something we pre-theoretically seem to believe to exist, is different from the other three dimensions in this respect, a question we might ask is: just what is it that makes us believe something like time exists? The answer appears to be change. It is very natural when we note a change in something to talk about the different properties constitutive of the change as occurring at different times. That is, when a change occurs, say a candle goes from being straight to being bent, we index these shape properties to temporal modifiers so we are not asserting that the candle is both straight and bent. Instead of simultaneously saying the candle is straight, the candle is bent (which would be a contradiction) we say the candle is straight at t_1 and bent at t_2. A candle could not have these incompatible properties if it weren't for its passage through time. It is accounting for change in this manner that leads us to believe in time. Furthermore, it appears that to be aware of an interval of time passing is to be aware of changes occurring during that interval. That is, it would seem difficult to notice time passing without any changes occurring. Indeed seeing how closely related time and change are, we might wonder whether or not it is possible for one to exist without the other. Now it is fairly clear that change involves time. It is obvious that without time, changes would not occur (and this is of course one of our reasons for inferring the existence of time). The interesting question, however, is whether or not time involves change. That is, is change a necessary condition for time to elapse? Sydney Shoemaker considers just this question in his essay 'Time without Change'[1].

Shoemaker begins by noting some well known philosophers who seemed to think that change was a necessary condition on time's passage. They appear to be saying that

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[1] Shoemaker does not formulate his question in this way, rather his question seems to be 'does time involve change?' While this formulation is a bit vague, I believe the best way to interpret it is that he is asking whether or not change is a necessary condition for time to elapse.

while time and change are not the same thing, time would not elapse absent any changes. He notes Hume, McTaggart and Aristotle as all holding a view similar to this. The general consensus is that we measure time via changes and thereby it seems plausible that there cannot be a period of time absent of any changes. Shoemaker also wants to distinguish *genuine* cases of change as the changes he is dealing with (this idea will come up later). Genuine cases of change are changes that occur in an object's 'primary' properties like color, size, mass, shape etc: what Shoemaker calls "properties with respect to which something *can* remain *un*changed for an infinite length of time"[2] (pg 364). We might consider what time would be like if it elapsed absent any changes. If time had this ability, then a billion years could have elapsed between your reading of this word and this word without you ever knowing it. For to read adjacent words requires a changing cognitive state, one that would cease to change in a 'frozen' interval of time[3]. As peculiar as this idea seems, Shoemaker is going to argue that, in fact, we have good reasons for thinking time can elapse absent any changes (that is, change is not a necessary condition for time to elapse). Before one completely dismisses Shoemaker due to this otherwise radical possibility, it must be noted that Shoemaker is examining whether or not changeless intervals of time are *logically* or *conceptually* possible not *physically* possible. That is, he is questioning whether or not we can have good reasons for conceiving of a changeless interval of time not good reasons for thinking our laws of physics could allow a changeless interval.

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[2] These are to be distinguished from non-genuine cases of change like change in relational properties, 'McTaggart-properties,' 'Goodman-predicates' etc. I find the notion of genuine change intuitive enough that we do not need to examine these non-genuine changes in detail.

[3] This, of course, raises the interesting and highly debated question of whether or not one would cease to exist during a changeless interval. An affirmative answer to this question would mean that one could, in principle, cease to exist a billion times throughout one's lifetime if changeless intervals are physically possible.

Shoemaker has us imagine a possible world in which there are three distinct regions, A, B and C. These regions compose all the matter in this world and are all distinguished by natural boundaries, but inhabitants of any region can, usually, pass to any other region. Further, inhabitants of one region can view the happenings of another region from their own region. Every so often in one of the regions, there is a 'local freeze' in which all developments completely stop or 'freeze.' That is, during a freeze, there are no changes occurring. Inhabitants from non-frozen regions can observe the frozen region from their region, but during a freeze, cannot pass into the frozen region. When the frozen interval ends, the inhabitants of the frozen region will continue on in whatever they were doing the moment before the freeze began as if it never occurred. All that will seem odd to them is that changes in the other non-frozen regions will appear to have occurred instantaneously. For during the changeless interval that elapsed in their frozen region, the other regions were undergoing changing intervals.

This possible world is still consistent with the idea that change is a necessary condition for time to elapse. For this requires only that some changes occur during an interval, not that all things change. All that we've demonstrated so far is that a subset of the set of things in this possible world can stop changing for an interval of time. Let us, then, imagine further that the inhabitants of the three regions begin investigating these local freezes further. They discover that the freezes follow a regular pattern. First off, local freezes always last exactly one year regardless of region. Secondly, in region A, local freezes occur every third year, in B every fourth year, and in C every fifth year. Given these regularities, local freezes occur in A and B every 12th year, in A and C every 15 year, in B and C every 20th year, and in A B and C every 60th year. Accordingly, every

60$^{\text{th}}$ year there will occur a 'total freeze' in which all processes in the possible world stop changing for an entire year. Thus, in this possible world, there will be an interval of time in which no changes occur.

The primary objection to this imaginary world is that inhabitants of the world do not have acceptable grounds for believing in total freezes. Merely inferring them from the regularity of local freezes is implausible. Since they can have no other evidence for the existence of total freezes besides the regularity of local freezes, they have no good reason to believe in them. In fact, the inference to the occurrence of total freezes is just as valid as the inference to the claim that each region skips a freeze every 59 years given the inhabitants observations. So the inhabitants actually have no reason to believe in the occurrence of total freezes absent any direct observation of such phenomena (which is impossible).

Shoemaker wishes to respond to this objection by appealing to 'inference to the best explanation'. Here, when two competing explanations for a set of events equally explain the data, the explanation that is simpler is often chosen as the correct explanation. Shoemaker wants to claim that the occurrence of total freezes is a simpler inference to make given the regularities than the inference that freezes skip every 59 years and this gives us good reason to believe it. The objector may reply that, in fact, positing changeless intervals is less simple than positing a 59 year skip in freezes. This is because the impossibility of direct observation of a total freeze makes total freezes unverifiable. That is, we can never verify the occurrence of a total freeze by means of a direct observation. Shoemaker responds that there is, of course, an indirect verification given the inductive inference from the regularities of local freezes to the total freeze and if we

are going to rule out this sort of indirect verification as unacceptable, then many of the inductive inferences we make daily should be unacceptable as well. For we often ground beliefs in things we may not have observed given certain regularities. Shoemaker notes that if all of humanity were to be sound asleep, we would still have good reasons for thinking that the earth would continue rotating. Here there is no verification of the rotation of the earth via direct observation, yet we still have good reasons to think that the earth continues rotating. As such, it appears that 'the directness' of verification plays no role in making one of the hypotheses simpler than the other. Thus it seems that the inference to total freezes is simpler than the inference to a 59 year skip.

Shoemaker goes on to consider the consequences changeless intervals have on the nature of time (i.e. whether it could be discrete or dense, etc.) as well as the consequences on the metaphysics of causation. While such a discussion is certainly necessary if changeless intervals are conceptually possible, examining it in detail is not necessary for our purposes. Crucially, we appear to have good reasons to think that changeless intervals are conceptually possible and thus change is not a necessary condition on time to elapse. Furthermore, given our own universe with its initial conditions and laws of nature, it seems highly improbable that a changeless interval is physically possible. However, if one were to occur it appears that it would be impossible for us to know about it.

Intuitions about Time

Change does, however, appear to be a necessary condition on our belief in the existence of time. For if it were possible to somehow make observations in a changeless world, it seems that one would never infer the existence of time. Without change, one has

no need for a belief in time. It is worth keeping in mind the interplay between change and time throughout the entirety of our discussion as well as Shoemaker's argument for the claim that change is not a necessary condition on time to elapse. If Shoemaker is correct then in the 'metaphysical sense' time does not supervene on change, however, in the 'epistemic sense' time does supervene on change. We will see that it is certainly possible to theorize about time without theorizing about change, but an account of the former seems incomplete without an account of the latter. Accordingly, the theories of time we will examine include theories of change that are consistent with their metaphysics.

In physics, time is generally used to help form equations that will account for a changing process. Since there seem to be no directly empirical effects of time, only indirect effects through change, physics tells us little about the nature of time or objects in time. Accordingly, describing the nature of time and objects in time has always been the duty of the metaphysician. As noted earlier, Einstein has most likely made the largest contribution on physics' behalf towards how time manifests itself in reality. Any metaphysical theory of time should take into account the consequences of his special relativity. However, since we have very little empirical guidance when performing metaphysics, it is always of utmost importance for the metaphysician to find and make clear our intuitions about metaphysical concepts as well as the language we use to speak of metaphysical concepts. Therefore, the metaphysician generally has two paths he can take: develop a theory that (among other things) supports our intuitions, or develop a theory that (among other things) explains why our intuitions are false.

Arguably our most fundamental intuition about time is that it is asymmetrical, it has a direction. If an egg rolls off a table and shatters into multiple pieces, the pieces

never form back together and fly up onto the table again. If two cars collide head on, the cars never move back apart, reforming any dents and fixing any windows to finally end up in the lanes they were originally in. We observe instances like these in everyday life and we infer from them that time only flows in one direction. This inference becomes interesting when viewed through the lens of basic physical laws. It turns out that most of the physical laws we've discovered, the law of conservation of momentum for example, pose no asymmetry on time. That is, it is equally coherent for the law of conservation of momentum to act in the 'forward' time direction as it is for it to act in the 'backward' time direction. This, of course, generates interesting questions about 'backward causation' that are usually uniquely tied to theories of time. Importantly though, most of the known physical laws can be viewed as time-direction-insensitive. In this sense, our most fundamental physics provide us with no reason to assume the asymmetry of time[4].

Given that we naturally infer the asymmetry of time, we have developed one *prima facie* method for distinguishing time into three essential constituents, the past, the present, and the future. These constituents are primary to the various tensed sentences we employ. For example, 'thank goodness my headache is in the past' or 'you'd better be planning for the future' or 'there's no time like the present.' Such language is a necessity for understanding what one has done with one's life, and what one plans to do. The two outer or 'limiting' parts, the past and future, depend on the central or 'mediating' part, the present, for their extension. I don't use extension in the 'three-dimensional' sense; rather the past and future are dependent on the present for how many entities have the property of 'pastness' or 'futureness.' That is, as the present plows forward, the 'size' of the past

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[4] The asymmetry of time is a debatable topic in the literature. We will not examine the debate in any detail later in this paper. The purpose of this paragraph, however, is to show that regardless of one's stance on the asymmetry of time, it is unavoidable that one has an intuition about its asymmetry.

grows and the 'size' of the future shrinks (assuming, of course, that time has endpoints). It is pretty clear that, on this interpretation, the three parts of time are all incompatible. No entity can be both future and present, or present and past, or future and past. At every moment of an entity's existence, it must have one and only one of the three properties past, present and future. Since such a view asserts the existence of a past present and future, it also asserts that facts tensed around the past present or future are constitutive of reality. Such a view of time was coined the 'A-series' in an important article by J.M.E McTaggart back in the early twentieth century. Accordingly, any metaphysician holding a view of time similar to the 'A-series' was called an 'A-theorist.'. There are many related views that are also considered 'A-theories.' For example the view termed 'presentism,' which asserts that the only existing things are currently existing things. Another similar view advocated by C.D. Broad and later Michael Tooley is that the past and present are real while the future is not real, but rather 'open.' Here the four-dimensional universe 'grows' into the future.

Another *prima facie* method we use for distinguishing temporal order, one not necessarily implied by an asymmetrical time-series, uses the fundamental two-place relations 'earlier than' and 'later than.' This method finds its way into our language almost as often as the A-series. For example, 'I'll be there earlier than he will be,' or 'I'll arrive later than 7 o'clock.' These examples demonstrate the need for demarcating a temporal order, and it is easy to see how they extend to necessitate a knowable causal order. Knowing which event occurred earlier than another event may be necessary for defining which event is a cause and which an effect. Further, it may be that the tensed statements of the A-theorist can be reduced to statements involving only relations of

earlier than or later than (we will see how this is done later). In the same article by McTaggart, this method of reduction and taking these relations as fundamental is called the 'B-series.' Such a view of time naturally produces B-theorists that stand markedly opposed to A-theorists. The B-theory is fundamentally different from the A-theory primarily in that when a B-relation obtains, it 'eternally' obtains. By this I mean, when one event *becomes* earlier than another event, it becomes necessarily earlier. In this sense, the relations given by the B-theory are *eternal* relations. That is, these relations are invariant throughout time. Accordingly, the view of time produced by the B-theory is often called 'Eternalism.'

Much like the A-theory, there are differing views under the general rubric of eternalism. For example, Ted Sider's view that objects in time are analogous to objects in space. A plausible spatial thesis is that an object is the sum of its parts. Sider believes temporal 'objects' are just the same. Therefore an object is only 'whole' given the sum of all its spatial and temporal parts. We will analyze this view in much more detail later. D.H. Mellor, also an eternalist, believes rather that objects are wholly present at every moment of their existence and their properties are simply relations the object has to times. Still further there are eternalists that believe the past present and future exist, but exist in the 'eternal' sense. That is, the past present and future are all equally real. These B-theorists get to employ the tenses used in the A-theory, however they deny what is generally common to B-theorists: the reduction of A-tenses to fundamental B-relations. It is also worth noting here that while the A-theory seems to support our primary intuition about time being asymmetrical, the B-theory seems to support the consequence that our

physical laws are time-direction-insensitive. This is because it is not necessary on the B-theory that time has a direction.

In this paper we will present and critically analyze the arguments for both the B-theory and A-theory accounts of time. This will entail discussions of both 'eternalism,' the view of time resultant from an adoption of the B-theory, as well as 'presentism,' one of the instances of the A-theory. We will begin with the B-theorist's reduction of tense to motivate three and four-dimensionalism. In considering four-dimensionalism, we will raise questions of composition that purportedly entail four-dimensionalism. We will then turn to three-dimensionalism, which tries to save an intuition we have about objects in time that four-dimensionalism denies. Next we will examine McTaggart's argument against the A and B-theories, the puzzle about change and the various responses to it and the possibility of instantaneous change. The presentist's solution to the puzzle about change will motivate his view which we will consider next. We will conclude by looking at a view that seems to transcend the distinction between the A and B-theory as well as giving new insight into McTaggart's argument called Fragmentalism. This view, we hope, will contain some of the most refined insights into the nature of time, change and the ontology of objects in time.

The Reduction of Tense

Tenseless Truth Conditions

We will begin by first examining the standard reduction of tensed sentences in which tensed sentences are given tenseless truth-conditions. Next we will look at how sentences involving a person's taking an object to be past present or future can be can be assigned tenseless truth-conditions. We will then move to Arthur Prior's famous 'thank goodness that's over' argument and see if the reductionist has a plausible way out of it. We will conclude by examining an intuition one might have about the 'necessary presence of experience' and the possibility of this intuition making tensed language more plausible. Finally, we will present Mellor's reductionist proposal regarding the 'necessary presence of experience'.

The use of tensed language is absolutely fundamental to our everyday communication. We use tense to exhibit understanding of how things were, how things are and how things will be. For example:

"I *used* to be a computer science major,"

"I am *now* a philosophy major,"

"I *will* finish my thesis."

This sort of language appears to be necessary for communicating with other people. Furthermore, this kind of language is formalized by the framework of tense logic[5]. Given these features of tense, it is often thought that tense or tensed facts are ultimate

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[5] We will examine the use of tense logic in relationship to 'presentism' in later pages.

constituents of reality. The supporters of tense as a feature of reality typically take tense to be a primitive notion with facts like 'Socrates was a philosopher,' being constitutive of reality.[6] W.V.O Quine believes that such a tense structure is a "breach of theoretical simplicity." This structure requires us to have every verb form show a tense and consequently, "it demands lip service to time when time is farthest from our thoughts" (from *Word and Object,*1960, reprinted by Westphal & Levenson in *Time*, 1993, pg 148). These sentiments motivate Quine to examine the other fundamental method by which temporal notions manifest themselves in our language. For example:

"I major in computer science *before* I major in philosophy,"

"I am typing on 10 February 2007,"

"I finish my thesis *after* I write the section on tense."

One primary way in which these latter, 'B-statements' distinguish from the former, 'A-statements' is that the former presuppose a vantage point within time. That is, the present is distinguished so the tenses can be oriented. The B-statements also enable us to order temporal events in a way that A-statements do not. The relations of before and after demonstrate a strict temporal ordering between two events while tensed sentences seem to have no analogous method for strict ordering[7]. Another primary way in which they differ is that tensed sentences can have variant truth values while B-sentences have invariant truth values. The truth value of 'I am *now* a philosophy major' could change from true to false if I decided to take up a different major. However the truth of 'I am

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[6] This formulation of tense as a primitive is typical of a presentist which we will consider later.
[7] Philosophers have attempted to reduce this notion to causal order and subsequently reduce all temporal statements to causal statements, a view also known as 'the causal theory of time'. This is not a view we will be discussing in this paper. The best discussion of it, in my opinion, is to be found in Lawrence Sklar's 'Space, Time and Spacetime'.

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typing on 10 February 2007' is permanently true, this fact will never change. It is worth noting that B-facts like this can either be 'timelessly permanent,' or 'becoming permanent,' given one's views about determinism.[8]

Quine was also motivated by the fact that B-statements treat temporal sentences in the same way that our language treats spatial sentences (pg 148, ibid). That is, there appears to be no spatial analogue for the tensed sentences we evoke to discuss time, while there is an analogue for timeless B-statements. Asserting the temporal B-statement that 'x is earlier than y' is analogous to asserting the spatial statement 'x is north of y.' However, the tensed form of the A-statement 'x was a figure skater,' appears to have no spatial analogue. Thus, B-statements allow us to distinguish temporal locutions in only one obvious way from spatial locutions (the fact that they're temporal) whereas tensed statements may require more than simply the fact that they're temporal to be distinguished from spatial locutions.

The final motivation for reducing tensed, A-statements to tenseless B-statements is that if such a reduction is possible, this suggests that B-statements are a more fundamental description of reality than A-statements. This suggests that, in the material mode, the properties 'past' 'present' and 'future' give way to relations of before and after between times. Following the path of D.H. Mellor (*Real Time II*), the reductionist attempts to create tenseless truth-conditions for tokens of tensed sentence types. Briefly, the distinction between types and tokens can be made by way of example: (1) Reed Reed. When we ask the question, 'how many words does (1) have?' The answer is that this

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[8] On the determinist view, B-facts are timelessly permanent. For example, in 1950 the B-fact that I'm sitting at 6:57pm on February 19th 2007 was already true, and always will be true. On an 'indeterministic' view, B-facts only have their permanent truth values when they become present. Thus, the B-fact that I'm sitting at 6:57pm on February 19th 2007 had no truth value until that time actually obtained.

question is ambiguous because (1) contains one type of word, and two tokens of that word. It is clear how this analysis of (1) extends to other cases. The reductionist generates tenseless truth-conditions for tokens of tensed sentence types because the truth-conditions must appeal to the temporal modifier 'at t.' 'At t' is going to vary for different tokens uttered at different times. This makes it very difficult to assign tenseless truth conditions to tensed sentence types. However, giving truth conditions for any token of a tensed sentence type proves to be just as strong. Thus if we consider a token x of a tensed statement like "it is now thundering" we can apply tenseless truth-conditions to it: x is true just in case it is thundering at t (where t is a variable that ranges over times). The consequent of this bi-conditional is a tenseless fact: if it is thundering at t, it will always be the case that it was thundering at t. Similar truth conditions can be given for tokens of past or future tensed sentences. Consider a token y of the tensed statement "Anna Nicole Smith used to exist." The tenseless truth condition of this token would then be: y is true just in case Anna Nicole Smith exists before t (where t is the time of the utterance of y). Now 'exists before t' is a timeless fact. Where philosophers met with some failure before in reducing tensed sentences was that they set out to translate all tensed language to tenseless language. This method of appealing to the truth conditions of tokens of tensed sentence types alleviates the need to do so.

Furthermore for the metaphysical distinctions of the A-theory, past present and future, the reductionist claims that these operate like indexicals when they're used as linguistic items. Indexicals are words that require a context before they can be judged true or false. Examples of indexicals would be the words 'I,' 'you,' 'here,' and 'now.' Thus, a sentence like "Harding is figure skating here now," is going to change truth

values based on where it is uttered and when it is uttered. If it is uttered at the Olympic figure skating competition when Harding is, in fact, figure skating, then it will be assigned the value true. If the sentence is uttered at Reed College when Harding is enjoying brunch with Colin Diver it will be assigned the value false. Similarly, "I am tired" is going to vary truth values based on who utters it. Indexicals like 'I,' 'you,' 'here,' 'now' do not have any semantic content until they are given a context, as shown in these examples. Consider a person x who utters, at t, 'event e is present.' This token is true just in case e occurs at t. Similarly for past and future: if x utters, at t, 'event e is past,' then x's utterance is true just in case e occurs before t and if x utters, at t, 'event e is future,' then x's utterence is true just in case e occurs after t. These truth-conditions are easily extended to any token containing a predication of 'is present,' 'is past,' or 'is future.' For example, let e be the event of *Hinchliff eating dinner on January 12 2007*. The token "e is past," is true just in case e occurred at a time later than January 12 2007. In this way, the reduced words 'past' 'present' and 'future' require a time before they are assigned a truth value much like indexicals require a context before they are assigned a truth value. Thus, the linguistic distinctions of past, present, and future are easily reduced to untensed language like 'before' and 'after.'

It is worth noting that this analysis of sentence tokens can be extended token perceptions and token thoughts. However, my use of the word 'perception,' may be a bit misleading. Paradigmatic uses of 'perception' typically mean something like 'direct sense impressions on the brain'. This will not be my use. My use of 'perception' will mean a 'taking an event to be' a certain way. More specifically, a person x will take an event e to be such and such. Thus, a statement like 'a person x perceives an event e as past' could

be interchanged with 'a person x takes an event e to be past' *salva veritate*. Furthermore, I will employ the word 'correctly' as a modifier on perception. For example, a person x *correctly* perceives an event e as past (again, a person x correctly takes an event e as past). Correctly, here, will be working to rule out cases of hallucination and so forth. Therefore, a person x correctly perceives an event e as past at t just in case the event e occurs before x's perception at t. Since I correctly perceive (take it to be the case that) the basketball game I played on March 2nd 2007 as past right now (a time later than March 2nd 2007), then it is past. I correctly perceive the typing of these words as present just in case they occur at the time that I perceive them. Finally, I correctly perceive, at t, the event, *handing my finished thesis in* as future just in case the event occurs after my perception, at t. Again, this isn't to say that I am 'seeing into the future,' rather, I'm taking the event *handing my finished thesis in* as future.

This analysis raises the interesting question: what if the event *handing my finished thesis in* never occurs (hopefully it does)? The reductionist who is typically an eternalist will hold that my perception of this event as future will already have its truth value before the event occurs. This is because the events in the future are just as 'real' as the events of the present and past on the eternalist view. However, as human beings, we have no *certain* epistemic access to the truth values of future events. I am of course setting aside cases of paradigmatic motion in physics. Clearly we do have some epistemic access to the truth values of future events insofar as a set of initial conditions in tandem with some basic physical laws entails the motion of an object. However, the event I am employing is obviously fundamentally different from cases like these. Thus, while this perceptual analysis works, we will never know if my taking it to be the case that *handing my*

finished thesis in is future is true or false until that event either occurs or does not occur, even though on the eternalist view, my perception already has a truth value.

These cases of perception seem to be special cases of a more general case: thought. The analysis of perception can be expanded to thought. If a person x thinks a thought S at t, that can be represented as 'e is future,' (where e is some event) S is true just in case the time of e's occurance is after t. Accordingly, if I think a thought about the event *handing in my finished thesis* such that the thought could be represented as '*handing in my finished thesis* is future,' this thought will be true just in case *handing in my finished thesis* is after the time of the thought. Clearly, this analysis can also be given for thoughts that ascribe 'is past' and 'is present' to events as well.[9]

Thank Goodness that's over

Another argument the reductionist must deal with is the 'thank goodness that's over' argument given by Arthur Prior (Prior, Arthur. 1959. 'Thank Goodness That's Over', *Philosophy*, 34: 12-17). Imagine a time when you were shoeless and stubbed your toe on some large heavy object. I assume there are very few people who haven't done this – we know it's generally a noticeably painful experience. What we seem to do in this case, and in all cases of pain, is feel relief when the pain has subsided. In the toe stubbing case the pain is usually sharp, but doesn't last that long. When the pain subsides we often say something like "thank goodness that's over." Prior's question is, what exactly is it that we're thanking goodness for? The most obvious answer, and the one Prior believes is

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[9] Note that this paragraph is not assuming that events can have the property of being 'past' 'present' or 'future,' rather it's attempting to give further tenseless truth-conditions for an agent's perception of an event being 'past' 'present' or 'future.'

that we're thinking goodness for the fact that our pain now has the property of being past – it is in the past. Since it's in the past we can no longer experience it (insofar as memory is to be distinguished from experience) given that at least *prima facie* experiences necessarily occur in the present. It is this fact that we are thanking goodness for, the fact that the pain is no longer present. However this is clearly not a B-fact at all, therefore the reductionist must account for this loophole where B-facts appear to fail in capturing an important feature of experience.

But wait, didn't we just give a reduction of what makes a predication of 'past' 'present' or 'future' to an event true? Yes – but Prior believes that simply appealing to the fact that I make the utterance, "thank goodness that's over" after the pain has occurred will not suffice. The fact that my pain is over at some time t was as true during the instance of pain (and epistemically accessible) as it was after the instance of pain; why should I not be glad about it at the earlier time and then suddenly be glad about it at the later time? There is no reason for me not to be glad of the fact during the painful experience and this seems absurd. Thus, Prior maintains, we must be thanking goodness for the A-fact that our pain is, indeed, past.

This conclusion, of course, admits the existence of irreducibly tensed facts. As a reductionist, Theodore Sider, in his *Four-Dimensionalism* believes arguments analogous to this can be given for the existence of other types of facts, for example, irreducibly 'personal' facts, and irreducibly 'spatial' facts. If arguments of this sort can admit metaphysically exotic, implausible facts, then there must be something wrong with the argument itself. Sider begins by appealing to an argument John Perry gave (from *Four-Dimensionalism,* 2003, pg. 18) which seems to entail the existence of 'personal' facts.

Imagine that Hinchliff is at the supermarket shopping. He notices a sugar trail on the floor that, presumably, is leaking from someone's shopping cart. After following it for awhile, Hinchliff realizes that he himself is the shopper with the leaky sugar container. In coming to this realization, there seems to be some new fact he comes to realize, a type of 'personal' fact. For he already knew the relevant 'impersonal facts.' He knew that *some shopper was making a mess*, perhaps he even knew that *a philosopher was making a mess,* he could've even known that *Mark Hinchliff is making mess*, since; due to amnesia, he might not know that he is, in fact, Mark Hinchliff. The fact of interest that he comes to realize is that *he himself is making a mess*. Such a fact can only be captured by the use of indexicals like 'I' or 'himself' which, because of their indexicality, are 'personal' terms such that they admit 'personal' facts. Luckily, Perry shows that we need not admit these metaphysically exotic 'personal' facts, rather, we ought to modify our understanding of belief. Beliefs and psychological attitudes are not exhausted by their relations to impersonal propositions. Before we continue with this line, however, let us consider the relevant personal case, and the spatial cases in which arguments analogous to Prior's are given with unacceptable conclusions.

Perry's argument can be easily modified to fit Prior's more closely. For example, we could ascribe to Hinchliff the psychological attitude, 'thank goodness that's not *me* making the mess' and then run the argument accordingly. Imagine a case involving spatial indexicals like 'there' and 'here.' For example, I am relieved that the pickters are over *there* and not over *here*. I must be relieved because of the existence of some spatial fact about the pickter's property of 'there-ness.' Such a fact could not simply be reduced to something like 'the pickters being in the quad rather than in Anna Mann' which is, in

fact, making me relieved. This is because I may be ignorant of where my location actually is and can only describe my relief with uses of 'there' and 'here.' Now Prior believes his argument is an argument for presentism. Thus it is not necessarily that one's pain has the property of pastness (because past and future objects do not exist on the presentist view) that is making one relieved, rather it is the irreducibly tensed fact that one *was* in pain, but is not in pain *now* that thereby makes one relieved. However, if such a conclusion is warranted by Prior's argument, then we could conclude from the analogous spatial and personal cases that distinct places and distinct persons do not exist. However, outside of presentism, the arguments parallel to Prior's admit a mélange of irreducible perspectival facts of *me-ness* and *here-ness*. Rather than postulating these obscure, unintelligible facts, we should instead be motivated to revise our understanding of psychological attitudes; exactly what Sider goes on to demonstrate.

Sider wants to propose a new theory of our attitudes to times that is unaffected by Prior's argument. Prior has shown that psychological attitudes cannot simply be relations to eternal propositions, propositions that have their truth value *simpliciter*, unless we wish to build exotic facts into the world. Sider, then, wishes to develop a new kind of proposition specifically for perspectival, psychological attitudes – temporal propositions. An attitude like relief is naturally perspectival – it does not reduce to eternal propositions. Sider wishes to introduce temporal propositions as functions (similar to the philosophers that believe atemporal or eternal propositions are functions from possible worlds into truth values). These temporal propositions take as their argument any time t, and assign that time to an atemporal proposition. To follow Sider's example, 'Hinchliff's pain is just now over,' would express the temporal proposition that assigns any time t to the

atemporal proposition that 'Hinchliff's painful experience ends immediately before t.' Sider calls this temporal proposition 'over,' and believes it expresses the linguistic meaning/content/semantic value of the sentence. Furthermore, any sentence involving the use of temporal indexicals will have a temporal proposition as its semantic value.

Accordingly, we can now apply temporal propositions to psychological attitudes like relief. Sider asserts that a psychological attitude just is a relation between a person and a temporal proposition at a time. Thus, instead of the object of Hinchliff's relief at t being some exotic personal fact, it is now a temporal proposition, namely the temporal proposition 'over.' Standing in the relation of relief to over is not like being relieved that some atemporal proposition 'over' is true. If this were the case, then Prior's argument would still go through: we could know that our pain was going to be over at t and thus be relieved during the pain, but we are not. Rather, recall the temporal indexical 'now' used in the temporal proposition 'over,' 'Hinchliff's pain is just now over,' this indexical coincides with the argument, t, of the function 'over'. This feature of the temporal proposition 'over' exhibits a perspective within time. That perspective, namely the set of moments t such that 'Hinchliff's painful experience ceases immediately before t' is true, is what makes Hinchliff relieved. Standing in that perspective is what it is for Hinchliff to be relieved that his pain is over. Sider illustrates another example using the temporal proposition 'approaching.' Having the psychological attitude of 'dread' simply is dreading the temporal proposition 'approaching.' This proposition assigns to 't' the atemporal proposition that a pain will happen to me shortly after t. More intuitively, the temporal proposition could be expressed as 'a pain will occur to me shortly after now,' and it is this proposition called 'approaching' that I dread.

Now Sider can account for the psychological attitude of relief expressed by "thank goodness that's over," in B-terms and can escape an appeal to exotic facts. However, Sider's discussion appears also to have shown one last aspect of experience that implies the A-theory of time. What seems to be the case in the "thank goodness that's over argument" is that the temporal proposition by which Hinchliff is relieved, 'Hinchliff's pain is now over,' seems to be expressing that Hinchliff's pain is no longer present. That Hinchliff's pain is no longer present is what this temporal proposition captures in using the indexical 'now' and hence explains why Hinchliff is relieved. This example seems to be a special case of a more general intuitive idea: our vivid, subjective experience necessarily occurs in the present (and thus implies the present).

The Necessary Presence of Experience

Take the instance of subjective experience you're perceiving right *now*. This perception seems to be a set of what you were seeing, hearing, smelling, touching and, perhaps, tasting in that instant. Now that the instant has passed, you can never experience that specific instantaneous set of experiences again. One might immediately object that you can experience this set again (keep in mind I'm talking about experiencing the members within the set, not the set itself), through memory. However, I think memory is, plausibly, to be distinguished from our subjective experience, our direct sense perception occurring at every moment. When we remember an experience, this 'experience' of remembering an experience appears to be fundamentally different from the direct sort of experience we have from moment to moment. In the former, one's brain is analyzing an area in which short and long-term memories are stored while in the latter one's brain is

directly analyzing sense-data incoming from one's sense organs. Let us dispel any worries involving dreams as well – the subjective experience occurring during dreams *also* occurs during the present moment, just like waking experience. Thus, it appears that the vivid, subjective, experience or perception of sense-data that occurs from moment to moment, necessarily occurs in the present. This, then, implies that distinguishing time into a 'present' is warranted and, plausibly, into the set of times before the 'present' (past) and the set of times after the 'present' (future). Thus, the reductionist must give an account of this necessary presence of experience in acceptable B-terms.

D.H. Mellor recognizes this intuitive idea about subjective experience and attempts to give an account of it in B-terms (from *Real Time II*, 1998, pg. 42). His answer begins with the idea of self-awareness or a 'conscious now-belief.' For me to believe that my pain is past, I must first believe that I was in pain and that I am now not in pain. This kind of self-awareness of my pain state is what Mellor uses to explain the necessity of the presence of experience in terms of B-facts. Simply put, awareness of being free of pain at t is a conscious belief (self-awareness) that my experiences at t are pain-free. However, some might say that while one is aware of one's own experiences, awareness itself is a type of experience. Accordingly, Mellor stresses a distinction between self-awareness and experience.

While awareness and experience are intimately tied and anything I'm 'aware' of is an 'experience,' it need not be the case that I'm aware of all my experiences. Mellor's example is that I need not have any conscious beliefs that I am now free of pain – this is frequently the case when one is not in pain. When I am free of pain I am rarely having a conscious belief that I am free of it, even though if I were to have such a belief it would

certainly be true. However, I think the example can go the other direction as well. Often times during an adrenaline rush (for me, basketball games) I will not be aware that I am in pain. In fact I won't have any awareness of my pain until the game has ended and the adrenaline rush is over. Again, if I were to have a conscious belief that I was in pain during the game, that belief would most likely be true. What this shows is that self-awareness (conscious beliefs about my experiences) is different from experiences proper. Self-awareness itself cannot be subsumed or equated to experiences because I need not be self-aware of some of the experiences I'm having. Thus, consider that in my present experience I am free of pain. I will be aware that I am free of pain just in case I have a conscious belief that I am free of pain. This belief will be true at t just in case all my experiences at t are pain-free. This analysis is easily extended to any case of conscious belief. If I have a conscious belief at t that Harding is a figure skater, this belief will be true just in case Harding is a figure skater at t.

Self-awareness, conscious now-beliefs about one's experience, is what leads us to the conclusion that experience necessarily occurs in the present. When I am self-aware of my experience is when my experience is occurring. These conscious beliefs about my experience happen *now*. Thus it seems self-evident that for an event e to be experienced by person x, the experience must occur in the present (where experience is defined as direct perception of sense-data or memory-data etc). It is from this fact that we distinguish events being past and future -- the present is the vantage point by which we make these metaphysical distinctions. Yet, it seems that the way in which we take our experiences to be present (via our conscious now-beliefs about experiences) functions in the same way that painlessness does. I need not conclude that my experiences are present

since I can have experiences without being aware of their A-times, but if I have a conscious belief about the presence of my experience, that belief is most likely true, just like the case of painlessness. However, if at any time I have the conscious belief that my experience is present, this will be true, whereas if at any time I have the conscious belief that my experience is painless, this may be false (if I'm actually in pain). The former belief is the one which the reductionist must account for.

Recall our original account of the perception 'event e is present.' This perception is true just in case event e occurs at the time of perception. The conscious belief that my experiences are present, the belief I ascribe to the experiences occurring *now* is made at a B-time (the time of ascription). Thus we can construct an analysis like the following: a person x has the conscious belief that 'x's experience y occurs in the present,' at t. This is true just in case y occurs at t. This analysis, then, can explain why we typically believe that our experiences occur in the *present*. And thus, we have a reductionist account of the necessary presence of experience.

This is the basic account of tense reduction typically found in the literature. Authors like Mellor also go on to give a reduction of, essentially, all things A-related to all things B-related. The theorist (usually an A-theorist) who wishes to reject this doctrine will typically posit that tensed sentences are primitive or basic. Presentists are generally in this category. The presentist will assert that it's a property of the world in the present moment that it was the case that dinosaurs existed. However the purpose of the reduction of tense is to motivate the traditional ontological thesis of 'four-dimensionalism,' originally advocated by Quine.

Chapter Two: Two Eternalist Theories of Time & The Conditions of Existence

<u>Four-dimensionalism</u>

Traditional Four-dimensionalism & the Quinean Perspective

The reduction of tensed language to the untensed language leads one to talk about time in a manner that is analogous to how one talks about space. If all tensed language is essentially reducible to untensed language like "earlier than" and "later than", relations that, to speak loosely, obtain in a 'spacelike' way, then why isn't time itself 'spacelike'. This was one of the principle intuitions that motivated metaphysicians like Quine to think of time and objects in time in a 'spacelike' way. Furthermore, this view was supported by Einstein's significant advances in physics. Special relativity, and the resulting Minkowski spacetime all maintained that the universe was four-dimensional. Here space and time were shown to be so interconnected that instead of using the phrase 'space and time,' they concluded that the contraction 'spacetime' was more accurate. Thus, for most, time was now thought of as a dimension analogous to the three spatial dimensions. The question this immediately raised, however, is: what does it mean for something to be 'spacelike'?

Since theorizing about space itself (whether space exists in itself outside of being populated with objects) is a difficult and controversial question, we look to the objects within space (considered 'spatial' objects) for examples of what is 'spacelike'. Perhaps the most immediate idea we have about extended objects is that they have parts. If an

object has an extension, then it must be the case that it has parts. Consider one's body for example. My legs, fingers, eyes, stomach, ribs etc are all part of the one object that is the body. Still more my cells, molecules, sub-atomic particles are all part of my body. And rather arbitrarily: the region of skin above my shoulder with a width of one inch is part of my body. In the same way that my body is made up of parts, the four-dimensionalist seeks to make time up of parts. Picture time like a loaf of bread. The loaf can either be finite if time has endpoints or it can be infinite if time is unbounded. Either way, the loaf represents the entirety of time. Now imagine slicing maximally thin slices of the loaf. These 'infinitely' thin slices would then represent the instants that constitute time as a whole. A simple way to think of a 'maximally thin slice' is like the slices used to calculate the area under a curve. When we take the integral of a certain function, we imagine placing rectangles in the area under the curve, then adding up the areas of all the rectangles. Now for a sufficiently 'curvy' curve we need the rectangles to be increasingly thin to fit the curvy lines. At this point mathematicians consider the thickness of the rectangles to be 'maximally thin' and accordingly assign a length of 'dx' to the thickness instead of a numerical value. Insofar as we can make sense of a maximally thin slice, these are what constitute the instants of time that make up the loaf. These instants are what four-dimensionalists call 'temporal parts.' Temporal parts need not merely be instants either. For example, the 20th year of my life is a temporal part extended throughout that entire year. This year long temporal part is composed of its own temporal parts as well. All my instantaneous temporal parts during that year are temporal parts of the year long temporal part, and all these temporal parts are parts of me (granted that we're examining *my* 20th year). The proliferation of parts can go on. While that 20th year

is a temporal part of mine, my foot has its own temporal parts as well. And these parts are equally a part of 'me' as any other parts already contributed to me. Such a view of parthood in relation to time brings up a unique, yet somewhat intuitive view of what constitutes a person.

Consider all the temporal parts that are part of you throughout your entire life. From infancy to adolescence to adulthood to death, the sum of these variegated temporal parts is 'you' on the four-dimensionalist view. Thus, you can think of 'you' as a sort of miniature loaf of bread. You are the loaf that is filled with all the slices (instants) of your life. Four-dimensionalists call this your 'spacetime worm'. Your worm extends back in time to when you became a person and forward in time to when you cease being a person[10]. The classic analogy four-dimensionalists have used to bring out this idea is that of a long road that extends through multiple types of terrain, for example, a road that goes from the plains through the forest up into the mountains. In the plains it's straight and flat, in the forest curvy and hilly and in the mountains bumpy and speckled with potholes. Now the road can have all these different incompatible properties because they belong to different parts of the road, and these parts make up the road as a 'whole'. Thus, analogous to the road, you have different incompatible properties and different times throughout your life. You were once an infant, then an adolescent, and perhaps now an adult. However, these different parts of 'you' make up the entire 'you' just like a roads different parts make up the entire road. On the four-dimensionalist picture, this is exactly how all objects exist 'in time'. All objects have a spacetime worm extending back to their generation and extending forward to their eventual destruction. These objects are made

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[10] Certainly controversial topics in philosophy.

up of different, temporal parts which are the primary bearers of their temporary incompatibly properties. However the sum of these temporal parts constitutes the object as a 'whole'.

What Quine is most concerned with in adopting a four-dimensionalist ontology is accounting for statements of the form x is F at t, an example being: "Pierce is sitting at 6:00pm on 11 February 2007." Quine wishes to develop a logical structure that will represent this locution with a complementary supporting ontology (from *Word and Object,* 1960, reprinted by Westphal & Levenson in *Time*, 1993, pg 151). An ontology must give an account of what Pierce refers too, what sitting refers too, and what 6:00pm … refers too. On Quine's view, Pierce is the worm extended through spacetime, 'sitting' is the intersection of Pierce's worm with 6:00pm … and 6:00pm … is the 3 dimensional cross section of the physical universe at that instant. What exactly is meant by 'the intersection of Pierce's worm with 6:00pm?' Pierce has an instantaneous temporal part at 6:00pm (within his spactime worm) that intersects at a certain spot of the 3 dimensional cross-section of the universe at the instant, 6:00pm. This temporal part has the property of sitting. Thus, there is this temporal part, call it Pierce-at-6:00pm that has the property of sitting. A simple representation would be: Sitting(Pierce-at-6:00pm). A 3 dimensional cross section of the universe is everything in the three dimensional manifold at that instant, 6:00pm. An easy way to picture this is as follows: imagine an earthworm extended on the ground. Imagine someone taking a razor and sticking it through the earthworm[11]. The earthworm here corresponds to Pierce's spacetime worm, while the razor represents the 3 dimensional cross section of the physical universe at 6:00pm 11

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[11] No earthworms were harmed in the creation of this example.

February 2007. Now the part of the razor that is touching the worm would be considered the intersection of Pierce with 6:00pm. It just so happens that this temporal part has the property of sitting. On Quine's view Pierce's spacetime worm and 6:00pm actually share a part in common. Thus while being a good picture, the earthworm example may not be entirely clear (unless of course the earthworm and razorblade could share a part). This is how Quine interprets, ontologically, statements of the form x is F at t.

Quine now wishes to formalize further concepts using the temporal modifier 'at t,' (Pierce at 6:00pm) and the relations of before and after. To capture, for example, the temporal parts of all mankind Quine uses the notion of classes or sets. Let the set z contain all of mankind. Now to say 'z at t,' we would write '$\hat{y}(\exists x)(y = (x \text{ at } t) \& x \in z)$'. This designates the class of all things y such that y is something (x) at t and that something is an element of the set of men (z). This technique could be easily extended to all sorts of temporally qualified sentences. 'Before' and 'after' become two place relations predicable of times. For example, $(\exists x)(x \text{ is before } t \& p \text{ at } x \text{ is drinking } w)$. Or, similar to our example, $(\exists x)(x \text{ is after } 5:00pm \& p \text{ at } x \text{ is sitting})$. These are fairly simple ways to formalize temporal sentences using logic.

Theodore Sider, a four-dimensionalist, believes that traditional four-dimensionalism has suffered from obscure or misleading formulation. For example, asserting that objects have 'extension in time' could naively mean that an object is present at more than one point in time – a fairly non-controversial thesis between four-dimensionalists and their opponents. Furthermore, David Wiggens maintains that objects persist through time, which he believes is to be distinguished from a four-dimensionalist notion of objects 'occupying' time (from Sider's *Four-Dimensionalism*, 2003, pg. 54).

These persisting objects gain and lose parts as they do on the four-dimensionalist view. However, it seems that a four-dimensionalist would accept both these doctrines, that objects persist and that they gain and lose parts. Thus an account needs to be advanced of a substantive difference between occupying and persisting. Peter Van Inwagen thinks he has not been given a sensible notion of what a temporal part is by traditional four dimensionalists (pg. 54, ibid). He believes further that no one really understands what temporal parts are supposed to be. Finally, some philosophers have held that there is no *bona fide* difference between eternalism (the view of time presupposed by four-dimensionalists) and presentism (a leading view of time in the A-theorists camp). The only disparity between the two are the usages of language evoked by either view – their views on the nature of time are equivalent. These sentiments lead Sider to present what I will call refined four-dimensionalism.

Sider & Refined Four-Dimensionalism

Sider's refined four-dimensionalism (from *Four-Dimensionalism*, 2003, pg. 55) begins by presupposing the B-theory of time (relations of earlier than and later than) and an eternalist view of time (past present and future are all equally real). As with most ontologies, Sider must claim that some notions are primitive or unanalyzable. The first is a mereological notion of a part at a time and the second is the spatiotemporal notion of existing at a time. Both of these primitives are fairly intuitive in our everyday lives. Pre-theoretically, it seems that one only has parts at times. The part of my hair at t_0 which I had before I received a haircut and was part of me is now not part of me at t_1 after I've

received the haircut. Furthermore, if the hair that is now not part of me at t_1 were to be set on fire at t_3, then we would say it existed at t_0 and t_1, but not at t_3. It may be the case that the notions of part-at-t and existence-at-t used in these examples are reducible to some more fundamental notions; however Sider wishes to take them as primitive and unanalyzable (it is worth noting that this is not a very recherché claim).

These primitive notions depart from other formulations of four-dimensionalism. Some four-dimensionalists wish to drop the temporal modifier on any part-at-t statement. These four-dimensionalists are said to have a view of *atemporal* parthood where objects have their parts *simpliciter*. Thus, objects never have a part at a time, they just have their parts. The desire to drop temporal modifiers is not unique in most four-dimensionalist views. Most four-dimensionalists claim that an object's temporal parts which bear its properties have those properties *simpliciter*. That is, a temporal part has a property atemporally, or without a relation to a time. For example, my desk's current temporal part has the property of being mahogany, but may later have a different temporal part bearing a different color. This construction is motivated by the solution it provides for the problem of temporary intrinsics, something we will examine later. These four-dimensionalists want to generalize this view by saying that my temporal parts, which compose my extended space time worm, are part of that worm atemporally. This view appears to fit into the four-dimensionalist view nicely, however it seems to be unmotivated. While there is a very good reason for dropping the temporal modifier when assigning properties to temporal parts, there seems to be no reason to do so in the case of parthood. However, it does allow us to speak of mereological change using the more

fundamental, untensed language of earlier than and later than. A spacetime worm has some parts earlier than other parts, and some parts later than other parts.

Even though this view may be unmotivated, there are instances of things having parts atemporally. For example, first order logic, second order logic, and modal logic are all parts of logic proper. We would not say that modal logic is part of logic at t, we would simply say modal logic is part of logic. Further, we would not want to say 'the 1990's are part of the 20th century at t' rather we'd say that the 1990's are part of the 20th century. These examples, however, differ from examples of objects in time, the latter of which almost always contain an appeal to temporality. If I plan to get my hair cut tomorrow then part of my hair now has parts in the future that are not parts of me then. However, today I must say that my hair is part of me now, and 'now' introduces temporality[12]. However these four-dimensionalists that reject part-at-t can take the notion of atemporal parthood as primitive and then define the temporary notion in terms of it:

(P@T): x is part of y at t if and only if x and y each exist at t and x's instantaneous temporal part at t is part of y's instantaneous temporal part at t.

As helpful as this is, it still begs the question to a three-dimensionalist. Both the idea of atemporal parthood and the use of 'temporal part' in the definition of part-at-t are notions the three-dimensionalist[13] rejects. For three-dimensionalists who believe parts must be temporally qualified to be well-formed, speaking of atemporal parthood to them is like stating a two place relation without putting anything in the second place. Further, it generally makes more sense to speak of a part-at-t than to speak of an atemporal part.

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[12] Recall that these uses of 'future' and 'now' can be give tenseless truth conditions as shown in the previous section.
[13] Three-dimensionalism is a view we will discuss in later sections. It differs primarily from Four-dimensionalism in that objects do not have temporal parts, but rather are wholly present at every moment of their existence.

Thus, Sider's own view which takes part-at-t as primitive will be agreeable to the three-dimensionalist since the three-dimensionalist will do the exact same thing. Since part-at-t can be defined in terms of atemporal parthood, (P@T), Sider's invocation of part-at-t will be acceptable to the 'atemporal four-dimensionalists' as well. In this sense, Sider's view proverbially 'kills two birds with one stone.' Sider can now formulate his view without begging questions to the three-dimensionalist or the atemporal four-dimensionalist.

Sider goes on to define two notions related to parthood that require temporal qualification: the notion of *overlapping* and the notion of a mereological fusion. First, overlapping is the simple notion of objects sharing parts in common. A mereological fusion[14] is an object that has a class of objects as its parts. Every part of the fusion is an object in the class of objects that composes the fusion, and each of its parts overlap a member of the class. Overlapping and fusions must be given at certain times. Sider also makes a distinction between 'proper parts' and 'improper parts.' Proper parts are those that constitute the object, my legs, my cells, my blood etc and an improper part is the object itself. Thus an object is an improper part of itself. We can now generate rigorous definitions of *overlapping* at a time, and *fusions* at a time.

Two objects *overlap* at a time if and only if something is part of each then.

x is a *fusion at* t of class S if and only if
(1) Every member of S is a part of x at t, and
(2) Every part of x at t overlaps-at-t some member of S

Given that Sider has imported the mereological notion of part-at-t as primitive, which is transitive, and it allows everything that exists at t to be part of itself, this entails

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[14] Certainly an abstract notion we will discuss later.

that x is part of y only if x and y both exist at t. This seems to entail the following further principle:

> (PO): If x and y exist at t, but x is not part of y at t, then x has some part at t that does not overlap y at t.

Given refined four-dimensionalism, if two spacetime worms share a temporal part (definition below), then they are parts of each other at that time. This denies the 'identity principle' which is commonly found in atemporal mereology.

Sider's other primitive, the spatiotemporal notion of exists-at-t, seems common to our everyday life as well. My Dad exists at the present time, but did not exist before 1950. My child does not exist at the present time, but exists at some time in the future. Similar to the way in which 'atemporal four-dimensionalists' attempt to define part-at-t in terms of atemporal parthood, (and do so using 'temporal part' in the definition) these four-dimensionalists also attempt to do the same for existence-at-t. For example, an object exists at a time just in case it has a temporal part that exists at that time. Again, such a definition would be rejected by a three-dimensionalist. Luckily, taking existence-at-t as primitive allows Sider to kill two birds with one stone again. The three-dimensionalist accepts this primitive (he uses the same primitive) and existence-at-t can be defined in terms of atemporal parthood, exactly what the atemporal four-dimensionalist wants. Next, he goes on to note that what is typically meant by existence-at, namely, atemporal quantification over all objects or the existential quantifier in logic, is not what he means by the word. Rather, his meaning is analogous to the spatial predicate 'is located at.'

With his primitives, part-at-t, and existence-at-t, and definition of overlapping he can now go on to rigorously define a 'temporal part.'

x is an instantaneous temporal part of y at instant t if and only if
(1) x exists at, but only at, t;
(2) x is part of y at t; and
(3) x overlaps at t everything that is part of y at t.

Note that this definition differs from another often used definition in which a temporal part of x exists only at t and has the same spatial location as x. The appeal to spatial location is used so that the temporal part of x is a sufficiently sized part of x. However, this definition will not include objects without spatial location, or an object sharing spatial location with one of its proper parts. Sider's definition allows a temporal part to be part of the object that exists instantaneously and is 'as big as' the object is at that instant (overlapping condition). Therefore, as stated during the discussion of traditional four-dimensionalism, my current temporal part overlaps my entire body and bears all my properties (77 inches tall, sitting, typing etc). Sider now has temporal parthood well-defined and can answer Van Inwagen's worry that no one knows what a temporal part is, if Van Inwagen concedes the existence of spacetime worms. Furthermore, he can formulate the general claim of four-dimensionalism: necessarily, each spatiotemporal object has a temporal part at every moment at which it exists.

Some four-dimensionalists wish to deny that temporal parts are instantaneous, arguing rather that they exist for an interval. Sider's definition can be re-formulated to account for temporal parts at an interval. An extended temporal part of x during interval T may be defined as an object that exists at, but only at, the times in T, is part of x at every time during T, and at every moment in T, overlaps everything that is part of x at that moment. The general claim of four-dimensionalism would then become: necessarily, each spatiotemporal object has a temporal part for a sort of interval, like extended

continuous intervals. Sider himself and most four-dimensionalists, however, assent to the existence of instantaneous temporal parts. Finally, Sider's definition can also be redefined using the notion of atemporal parthood, precisely what the atemporal four-dimensionalist would ultimately want:

> x is an instantaneous temporal part of y at instant t if and only if
> (1) x is part of y;
> (2) x exists at, but only at, t;
> (3) x overlaps every part of y that exists at t.

Given some of the motivations for why we should believe that temporal parts exist, this is Sider's argument for *how* they exist. Having four-dimensionalism motivated in tandem with a detailed explication of how its controversial entities exist and dodging some traditionally question begging claims, leads Sider to the general four-dimensionalist claim that temporal parts do, in fact, exist. This is, of course, not to say that temporal parts are more fundamental than the objects to which they are part, or even that objects themselves are constructed of their temporal parts. Further, it does not entail that the identity of a persisting object is to be demonstrated by its temporal parts (all areas were an opponent might look for room to object). It also makes no claim to the question of whether or not any spatiotemporal objects are continuants. All it achieves is a well-formed non question begging thesis to the conclusion that temporal parts exist, exactly what Sider needs to get four-dimensionalism off the ground.

The conditions of existence

Unrestricted Mereological Composition

Sider believes that the strongest argument in favor of four-dimensionalism stems from its answer to the question: under what conditions do objects begin and cease to exist? To break ground in answering this question, Sider introduces David Lewis's argument for unrestricted mereological composition (from *On the Plurality of Worlds*, 1986). He then demonstrates how Lewis's argument applies to the four-dimensionalist picture and, with his definition of temporal part in hand, thereby entails four-dimensionalism[15]. After examining how Sider's modified argument for unrestricted mereological composition entails four-dimensionalism, we will consider an objection and response to four-dimensionalism often coined 'Kripke's disks'. Finally, we will analyze another view about composition, coined 'brutal composition,' that may be more plausible than Sider's unrestricted view. Since this view places intuitive restrictions on composition it will block the entailment of four-dimensionalism. Our point of departure will be Sider's refined version of Lewis's argument for unrestricted mereological composition.

First, what is meant by unrestricted mereological composition? What this essentially means is, assemble any arbitrary class of objects, now imagine every object in the class composing another object, namely, the *fusion* of the class. This fusion is

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[15] He then takes the four-dimensionalist theory of unrestricted mereological composition and examines how it handles paradoxical cases of coincidence. Examining this aspect of his argument, however, will take us too far afield.

(usually)[16] a further object in addition to the objects within the class, the object whose parts are contained within the class. Unrestricted mereological composition maintains that we can take a fusion of any class of objects and get another object. Thus, the class of all objects that composed the Twin Towers can 'fuse' together to compose a further object(s). Before the Twin Towers were destroyed, this fusion accorded with our intuitions. We would agree that this is an appropriate instance of a class of objects composing a further object(s), namely, 'the Twin Towers'. However, the sympathizer of unrestricted mereological composition asserts that after the Twin Towers were destroyed, and the debris was moved off-site, the same class of objects still fuses to compose an object. Now, holding such a view contrasts with our intuitions. Typically, we take mereological sums to be various objects that are spatially and temporally contiguous, specifically, more contiguous with each other than with other objects not in the sum, as well as acting in a joint manner. We are apt to admit the class of objects that constitute the Twin Towers before they were destroyed as a mereological fusion because all the objects are spatiotemporally contiguous and act jointly. However, upon the destruction and subsequent removal of the towers, our intuitions tell us that these objects are no longer a mereological sum called the 'Twin Towers.' Consequently, our intuitions appear to tell us that there are restrictions on composition, disparate entities like the objects left after the destruction cannot compose a further object (insofar as they remain disparate). Unfortunately for our intuitions, there seem to be good arguments for the falsity of restrictions. Sider's argument (which builds off of Lewis's argument) runs as follows:

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[16] The fusion of a class of objects need not always compose a further object. In cases of a class where one of the members of the class is the fused object and the other members are parts of that object, there will be no 'further' object. For example, the fusion of the class containing Pierce's hand and Pierce will be Pierce.

P$_1$: If not every class has a fusion, then there must be a pair of cases connected by a continuous series such that in one [case], composition occurs, but in the other [case] composition does not occur.

P$_2$: In no continuous series is there a sharp cut-off in whether composition occurs

P$_3$: In any case of composition, either composition definitely occurs, or composition definitely does not occur.

These three premises in tandem with the claim that composition is restricted

generate a contradiction. Thus they imply just the opposite: that composition is

unrestricted. By sharp cut-off, Sider means a pair of adjacent classes in which, in the first,

composition definitely occurs, and in the second, composition definitely does not occur.

Let us consider the case already at hand: the Twin Towers before destruction and the

Twin Towers after destruction. To reiterate, our intuitions tell us that in the former we

definitely have a case of composition while in the latter we definitely don't. Let us call

the case of the constructed Twin Towers 'TT$_1$,' and the case of the destructed Twin

Towers 'TT$_5$.' Now, let us imagine the series of classes connecting TT$_1$ to TT$_5$: {TT$_1$,

TT$_2$, TT$_3$, TT$_4$, TT$_5$}. Consider the time distinction between these to be small enough that

for each class, the adjacent class is extremely similar to it in the relevant respects. Sider

believes these relevant respects to be: qualitative homogeneity, spatial proximity, unity of

action, comprehensiveness of causal relations and … (he believes their may be more).

The series of classes TT$_1$ – TT$_5$ can be called a 'continuous series connecting TT$_1$ to

TT$_5$.' Thus, for mereological composition to be restricted, it must be the case that there is

a point in the continuous series connecting TT$_1$ to TT$_5$ in which a sharp cut-off is made,

and we can distinguish between composition occurring and composition not occurring.

However, Sider wants to say that there is no such point in the series. The classes adjacent

to one another are so similar in the relevant respects, there is no point at which we can make this distinction. [17]

Perhaps someone will object that there is a sharp cut off in the Twin Towers case. They might assign to TT_4 the class of objects immediately before the time of collapse, and TT_5 as the class of objects immediately after the time of collapse. To block such an objection, Sider notes that we can keep slicing time down to smaller and smaller durations and in so doing, add more classes to a continuous series such that each class gets increasingly similar to its adjacent classes. Thus, the TT series could be broken into more closely similar classes – as many as it would take to mitigate the chances of a sharp cut-off. As Sider notes, to insist on admitting a sharp cut-off in a continuous series would be to insist on something that seems wholly 'metaphysically arbitrary'.

Sider believes his most controversial premise is P_3. Accordingly, he provides an extra argument for that premise independent of the other two:

S_1: If P_3 is false then it is vague whether composition occurs or does not occur.

S_2: If it could be vague whether composition occurs, this could happen in a finite world.

S_3: Some numerical sentence would then be indeterminate in truth value.

S_4: But, aside from the predicate 'concrete' which is non-vague, numerical sentences contain only logical vocabulary, and logical vocabulary can, plausibly, never be a source of vagueness.

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[17] Let us dispel an initial objection to P_1. One might object that not every pair is connected by a continuous series because there could be a class with finitely many objects that could not be connected to a class with infinitely many objects. While this is true, claiming that it somehow bears on composition, or more generally, on the conditions under which objects begin and cease to exist, is to make a claim few would want to make. Finitude and infinity should not determine whether or not TT_1 and TT_5 are mereological sums. There is also, of course, the view that no case of composition *ever* occurs, but we will set this view to one side.

Vagueness, used here, applies to the semantic theory of vagueness, which holds that a linguistic item is vague is when it is semantically indecisive. To be semantically indecisive is to have multiple 'precisifications,' different meanings that may make a term semantically 'precise'. None of these meanings has been uniquely individuated as being the term's meaning. For example 'tall' may be 'being at least n feet off the ground' for various positive integers n. Any value put in 'n' would change the meaning of 'tall.' Thus, if there is a case where we are unsure whether composition occurs or does not occur, then composition is vague in an analogous manner. One area an opponent may immediately look is at the description of a class. For example, 'the class of particles immediately in the region of the Twin Towers (before Sept 2001)' may very well be semantically imprecise. For Sider, though, P_3 is dealing strictly with classes themselves, not the descriptions of classes. P_3 also only deals with the existence of a fusion, not its nature. Thus it may be vague whether a certain fusion of molecules counts as the 'Twin Towers,' but P_3 need not answer this quandary, for it only deals with existence of fusions. Sider, now, goes on to formulate a definition for a class C having a fusion; in terms of the definition of 'fusion' (in terms of parthood) we gave earlier:

(F): There is some object, x, such that
    (1) Every member of C is a part of x, and
    (2) Every part of x shares a part in common with some member of C.

Given this definition and some class C, if F has no truth value, then this must be because whether or not fusion (composition) occurs is vague. Therefore, one of the terms within (F) must have multiple precisifications for (F) to be vague. However there don't seem to be any vague terms in the definition. Certainly ascriptions of parthood can be vague, 'the outback is part of Australia,' is definitely vague, but this doesn't imply that *is*

part of is vague. Sider can argue for P₃ without any assumptions about parthood, because of the inference from S₂ to S₃. Basically, if it were vague whether a certain class had a fusion then it would be vague how many concrete objects exist. Since a sentence demonstrating how many concrete objects exist can be shown using purely logical vocabulary, (a numerical sentence) Sider can assume the weaker claim that logical vocabulary is non-vague.

To show this, Sider begins by defining *concrete* objects negatively: concrete objects are all objects that are not part of the following list, sets and classes, numbers, properties and relations, universals and tropes, possible world and situations, and any other abstract entities one can think of. Now if P3 were false, it would be vague whether or not a certain class is a fusion. Imagine the class that contains all the concrete objects in the world. Now clearly such a class would contain every concrete object, but it would be unclear whether it included another object, namely, the fusion of the class. Since it seems safe to assume that finitely many concrete objects exist, we could represent a statement including every concrete object as a numerical sentence. Thus if the opponent of unrestricted mereological composition is correct, a numerical sentence asserting that there are n many objects for a finite value of n would be vague. However, such a sentence contains only logical vocabulary and the concreteness predicate 'C.' Sider's example of such a sentence is one that asserts two concrete objects: $\exists x \exists y((Cx \& Cy \& x \neq y \& \forall z(Cz \rightarrow (x=z \lor y=z)))$. The numerical sentence that expresses how many concrete objects there are would take on exactly this form, although it would be substantially longer. Now, if an opponent claims that P₃ is vague, they are, in turn, claiming that some

element of this numerical sentence is vague. However, this sentence only contains logical vocabulary and a concreteness predicate that has been well-defined.

The Entailment of Four-dimensionalism

Sider moves now to characterizing fusions at a time and fusions at different times. He calls the latter 'diachronic fusions' which simply means cross-time fusions. For these he uses a function which takes one or more times (one time would be a fusion at a time) and assigns non-empty classes that exist at those times to them. He calls these functions 'assignments.' Something would then be a diachronic fusion or D-fusion of an assignment f just in case for every t in f's domain, x is a fusion-at-t of f(t). Thus, if we wanted the D-fusion of myself from 12:00pm to 12:30pm, we would take an assignment function f which assigns certain times in between 12:00pm and 12:30pm (sliced arbitrarily) to the sub-atomic particles in the immediate vicinity of my body. Given that, for each of those times t, I am the fusion of these sub-atomic particles in f(t), I am a D-fusion of f. The interesting D-fusions will be the ones that are D-fusions of assignments that contain every moment of an objects existence – from the moment it begins to exist to the moment it ceases to exist, in their domain. Sider names these types of D-fusions 'minimal D-fusions.' Therefore, I am not a minimal D-fusion of the assignment from 12:00pm to 12:30pm because I exist at times before and times after those two times. I would be the minimal D-fusion of some assignment whose domain began with June 25th 1985 at approximately 6:00pm and ended with whenever I cease to exist and assigned these times to the sub-atomic particles in the immediate vicinity of my body. With this

apparatus in place, we can now restate our original question, namely: under what conditions does a given assignment have a minimal D-fusion?

Sider's answer to this question is that every assignment has a minimal D-fusion, or minimal D-fusions are unrestricted. Thus, the purpose in laying out the previous argument for unrestricted mereological composition was to extend it to his argument for unrestricted minimal D-fusions:

> P_1': If not every assignment has a minimal D-fusion, then there must be a pair of cases connected by a 'continuous series' such that in one, minimal D-fusion occurs, but in the other, minimal D-fusion does not occur.
>
> P_2': In no continuous series is there a sharp cut-off in whether minimal D-fusion occurs.
>
> P_3': In any case of minimal D-fusion, either minimal D-fusion definitely occurs, or minimal D-fusion definitely does not occur. (pg 134)

Given this restatement of the original argument the motivations and support for each premise that applied to the original argument translate to the second argument trivially. Importantly, P_1', P_2' and P_3' imply the following: every assignment has a minimal D-fusion. Sider believes that this implication entails four-dimensionalism. If we recall, the foundational four-dimensionalist thesis is that every object, x, will have a temporal part at every moment of its existence. Following Sider (pg 138), let A be the assignment with only t in its domain that assigns {x} to t. Now the fact that every assignment has a minimal D-fusion assures the existence of an object, z, that is a minimal D-fusion of A. What Sider wants to show is that this object z is a temporal part of x at t. Recall the definition of a temporal part:

> (1) z is a fusion of {x} at t. It follows from the definition of 'fusion at t' that every part of z at t overlaps x at t; by (PO), z is part of x at t.
>
> (2) Since z is a minimal D-fusion of this assignment, z exists at but only at t.

(3) Let y be any part of x at t. Since z is a fusion of {x} at t, x is part of z at t; thus, y is part of z at t; thus z overlaps y at t. So: z overlaps at t every part of x at t.

Assuming that we agree with Sider's argument for unrestricted minimal D-fusions, and believe temporal parts can be defined in this manner, then it seems that there is no escaping the entailment of the primary four-dimensionalist claim that every object has a temporal part at every moment of its existence. Since Sider believes these arguments to be both plausible and convincing, he takes this to be the best argument in favor of four-dimensionalism.

There is, however, one position that can deny the entailment of four-dimensionalism while maintaining unrestricted minimal D-fusions. This position is called 'mereological essentialism' and holds that all an objects parts are essential too it. The mereological essentialist can further hold a three-dimensionalist view where objects are wholly present at every moment of their existence. Sider calls the combination of these views the 'nothing-but-3D-sums view'. This view posits: if x is ever composed of y's, then: at any time at which each of the y's exist, x exists and is composed of them; and at any time at which x exists, it is composed of the y's. Such a view has no need for temporal parts, since objects aren't spread out through spacetime like a spacetime worm. Thus, he can (1) agree with Sider about unrestricted D-fusions, (2) hold that z need not be a temporal part but rather the entire object of which each of its parts are essential. Sider wishes to make four-dimensionalism more plausible than the nothing-but-3D-sums view. He does so by comparing various four-dimensionalist solutions to various mereological essentialist solutions for the paradoxes of coincidence. However, critically analyzing these would take us too far afield. Suffice it to say that the four-dimensionalist solution is

at least more intuitive than mereological essentialist solution (the idea that every part of an object is essential to it is *prima facie* implausible). Thus, we will turn now to objections to four-dimensionalism.

Kripke's disks

One of the most notorious objections to four-dimensionalism, or any theory of time and change that posits temporal parts of objects, is the objection coined 'Kripke's disks.' In this objection, we imagine a possible world in which there are two duplicate, homogeneous, continuous, perfectly circular disks of uniform depths. One of the disks is rotating and one of the disks is stationary. The question posed to four-dimensionalism and really any theory of persistence is this: what explains the difference between the two disks? Luckily for the three-dimensionalist, he can explain the difference effortlessly. If the object is an enduring object, wholly present at each moment of its existence, its parts are enduring as well. If the disk is rotating, then these parts will have different locations at different times. Thus if we want to distinguish the rotating disk from the stationary disk, we simply appeal to the ever-changing locations of its enduring parts. However, the four-dimensionalist lacks such an easy solution.

The reason Kripke's disks are so threatening to the four-dimensionalist is that they aim to rule out the possibility of a genidentity relation and if they succeed in doing so, then they dismantle the four-dimensionalist's view of a continuant, something essential to any ontological theory. A continuant, simply put, is an entity that persists for some duration of time. On the four-dimensionalist view, entities persist by gaining and losing temporal parts every moment. Thus, a continuant is a spacetime worm with a

succession of temporal parts. For a four-dimensionalist to explain how these temporal parts are all part of the same entity, he appeals to a 'genidentity' relation. Genidentity is concerned with the genesis of an object through time. The underlying picture is to take each instant of an object's path through spacetime like snapshot. Each of these snapshots is related to the snapshots previous in that they are somehow dependent on the previous snapshots and give rise to future snapshots. These relations between snapshots are called 'genidentical relations.' Such genidentical relations are essential to the four-dimensionalist framework. Entities have a succession of temporal parts, each part genidentically related to one or many parts preceding it. The most intuitive reduction of the genidentical relation is as follows: 'snapshots' are genidentical just in case they're connected by a spatiotemporally continuous sequence of snapshots. However, Kripke's disks challenge this reduction.

For the genidentical relation to explain the rotation of the one disk, the temporal parts of the rotating disk will need to have different patterns. That is, the temporal parts will need to have a helical pattern in the case of the rotating disk and a straight line pattern in the case of the stationary disk. If the genidentical relation simply is the spatiotemporal continuity relation, then this distinction in pattern is impossible. For the disks have both straight and helical patterns of successive temporal parts. Thus, on the four-dimensionalist view, we cannot distinguish between these two disks that should be distinguishable.

Sider develops a response drawing on Tooley, Robinson, and Hawley's non-reductionist account of velocity as a vector quantity and also David Lewis account of natural laws which states that the set of natural laws should be a deductively closed set of

propositions that achieves the best combination of simplicity and strength (from *Four-Dimensionalism,* 2003, pg. 228-236). 'Strength' is meant to designate how well the set of propositions captures the facts about the world while simplicity designates how easily the laws can be stated given a language representing natural properties and relations. However, instead of restating Sider's response I will point us toward Sider's own analysis of his response. He notes that this objection is an instance in which the four-dimensionalist must, proverbially, 'bite the bullet,' and accept the implausible consequences of his rejoinder. He feels this way because, as a consequence of his rejoinder, he cannot distinguish the rotating state of the disk from the stationary state unless there are other 'extrinsic' features of the possible world such that he can "give genidentity and [natural] laws a foothold" (pg 233). Accordingly persistence altogether becomes a sort of extrinsic matter governed by what contingent features hold in a certain world. Thus, while remaining tenable, this response certainly appears implausible.

Markosian's 'Brutal Composition'

One place where an opponent of four-dimensionalism would like to object is Sider's argument for unrestricted mereological composition. If we could somehow dismantle this fairly strong argument for the counter-intuitive result that composition is unrestricted, we could block the entailment of four-dimensionalism. Blocking this entailment would then dismiss Sider's strongest argument in favor four-dimensionalism.

Sider appears to have given a very solid argument for the conclusion that composition is unrestricted. His argument makes sense for all the concrete objects we typically take to be composed: cars, trains, tables, towers – his argument admits the cases

we intuitively believe to be composed. However, his argument also generates some highly counter-intuitive results. While satisfying our intuitions on the one side, unrestricted composition also admits a wide variety of case outside of anything we intuitively believe. 'Unrestricted' means that *any* class of objects composes a further object. Thus the class containing Tonya Harding's skates, Eddie Cushman's shoes, the top 5 inches of the Eiffel tower and Ronald Regan's hair composes a further object whose parts are those four things. The proliferation of classes like these appears to outweigh even the classes of concrete objects that we intuitively believe to exist.

Ned Markosian objects to unrestricted composition on similar grounds and asserts that this consequence is simply the fatal blow to the doctrine. That is, this doctrine falls with the fact that it admits a wide variety of case that appears to verge on radical absurdity. However I think it can be taken one step further. One of Sider's central claims is this: take any case we intuitively think is a case of non composition and connect it to a case we intuitively think is a case of composition using a continuous series. Indeed, Sider would attempt to connect the abstract object we spoke of to a case of composition using a continuous series. However, I assert that such a case and the myriad of cases like it cannot be connected by a continuous series to a case of composition. For what would such a continuous series look like? And what would be the case of composition such an abstract object connected too? It appears to me that the task of connecting an object like the one spoken of above using a continuous series is impossible. Especially if the cases used for connection have to be actual.

In the Twin Towers example, we have a series of actual cases connecting the constructed Twin Towers to the destructed Twin Towers. All the instants in between the

constructed Twin Towers and the destructed Twin Towers are instances of the continuous series connecting them. As the top of the towers fall downward, each instant in that time period will be another case in the continuous series connecting the two. These cases are 'actual' in the sense that they really existed in the actual world. If the requirement on connecting a case of non-composition to a case of composition is that one must use actual cases, then the prospect of connecting our radical object appears to be impossible. If 'possible' cases could be used, i.e. cases at possible worlds, the impossibility may be lessened; however it is not at all clear how this would be cashed out. The payoff of all this is that we have a multitude of cases of non composition that cannot be connected to cases of composition by a continuous series. Thus, there are classes, many of them, that cannot compose further objects. If this is true then it must be the case that composition is *not* unrestricted. Finally, it follows that Sider's argument no longer entails four-dimensionalism. If this is true, then just what is the restriction(s) on composition? Is there a non-vague answer that can be given?

Let us picture yet another case: imagine a toy horse. The sub-atomic particles in the immediate vicinity of the horse definitely compose the toy horse. Suppose we toss the toy horse into a fire, the horse slowly burns, turns into ash, and is spread about the environment by the wind. After it become ash, the sub-atomic particles that used to compose the toy horse, intuitively, no longer compose anything. It seems that we can split this process, and most other instances of composition/non-composition into three time intervals. The interval from a time, t_1, to time t_k represents the interval in which we're 'certain' composition occurs. The interval from time t_k to time t_n in which we're

'uncertain' whether or not composition occurs and the interval from time t_n to time t_p in which we're certain composition does not occur. We could represent this as follows:

$$\{t_1 \ldots\ldots\ldots\ldots\ldots\ldots t_k \ldots\ldots\ldots\ldots\ldots\ldots\ldots . t_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots t_p\}$$
[certain(composition)][uncertain(composition)][certain(~composition)]

The important interval in these cases is, of course, the 'grey area' or the interval in which we're uncertain whether or not composition is occurring. What Sider has attempted to do is, in some sense, equivocate the 'grey area' with the first interval. Instead of there being a grey area where we are uncertain, composition always occurs, or rather, is unrestricted. Another view advocated by Peter Unger postulates just the opposite: 'nihilism,' as Van Inwagen calls it, (from *Four-Dimensionalism,* 2003, pg. 187-8) equivocates the grey area with the last interval. That is, composition *never* occurs on this view. Rather the particles (often referred to as 'simples,' i.e. objects that have no parts) we take to compose the various, disparate objects we encounter in everyday life just so happen to be arranged in such and such form. Instead of saying 'there is a monitor in front of me,' a nihilist would say 'there are some simples arranged monitor-wise in front of me,' and, accordingly, reduce all fusion-like talk to simple-arrangement-like talk. Both of these theories deny strong intuitions we have about composition: the former admits far too many radical, absurd objects while the later denies the existence of objects we intuitively take to exist. There is also Van Inwagen's view that only *living* things are fusions (from *Material Beings*, 1990). This too appears to restrict composition more than our intuitions would allow. Accordingly, I prefer something like answer proposed by Ned Markosian. This answer is a bit displeasing, but I take it to be 'the least of four evils'.

Markosian draws on something that seems obviously true assuming our intuitions are correct: that there is a fact of the matter where the sharp cut off is in the grey area. That is, there is a point in the grey area in which a pair of adjacent cases differs in whether or not composition occurs and this point obtains regardless of our ability to identify it. Our ability to designate such a cut off is beside the point. In every case including composition and non-composition there is a 'brute fact' about the world where the sharp cut off in the continuous series occurs. This fact is 'primitive' in that it cannot be derived from any other fact – it stands alone. We can imagine why Markosian needs this fact to be 'brute' in this sense. If we were watching a film of the burning toy horse in slow motion, could we designate the point in which we have composition on the one hand and non composition on the other? Could some physical description be given like 'such and such particles were such and such distance from one another, thus we no longer have composition'? The answer clearly seems to be 'no'. For what principle would we appeal to in making this judgment in composition? Such a principle that was general enough to apply to all cases including composition and non composition appears to be beyond us at this point. Thus, since our intuitions require that there be some fact of the matter, it must be 'brute' in that it could not be analyzed by some physical description that appealed to further facts.

While providing an answer that accords with our intuitions this answer is displeasing simply because it postulates brute facts that we have no means for identifying. If these facts were epistemically accessible then, plausibly, they would no longer be brute. The problem is that it seems that many metaphysical problems could be solved by an appeal to brute facts. An ethicist could claim that one course of action is

morally 'good' and another course of action is morally 'bad' because a brute fact about

the moral status of courses of action obtains in the world that we cannot locate. Such an

answer would certainly be unsatisfying. However, in weighing the alternative answers to

the question of what is necessary and sufficient for composition, this answer appears to

be the best (or least evil). We either radically expand or shrink our view of composition,

or we simply appeal to brute facts. The latter seems to be the most satisfactory route.

Since this appears more acceptable than Sider's unrestricted mereological composition,

and it is only his view of composition that entails four-dimensionalism, we need not think

that composition entails four-dimensionalism if we accept Markosian's view. This

concludes our discussion of four-dimensionalism. Four-dimensionalism will return when

we discuss change and persistence, for now, we will turn to three-dimensionalism.

Three Dimensionalism

Three-dimensionalism begins by accepting the thesis of Eternalism.[18] That is,

three-dimensionalists accept the reduction of tense, and believe that all times are equally

real and existent. Thus, three-dimensionalists are very similar to four-dimensionalists in

this respect. The main tenet of three-dimensionalism is that continuants are 'wholly

present' at every moment of their existence. This is obviously different from the four-

dimensionalist claim that continuants are their spacetime worms, or the summation of

their temporal parts. It appears that both of these ways of thinking about continuants

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[18] Note here that I am distinguishing three-dimensionalism from presentism. Many often place presentism under the general rubric of three-dimensionalism since presentists usually accept the thesis that objects are wholly present at every moment of their existence. I, however, will leave them distinct.

draws on different senses in which something might be a continuant. In some intuitive sense, it seems that, yes, I am all those instants that constitute my life. The object called 'Pierce' is all of the moments of his life from birth until death. This appears correct in a sense. However, it also seems intuitive to say that I am me at each instant of my life, not a temporal part of an extended spacetime worm. Take any moment of Pierce's life and that just is Pierce, Pierce is not some object made up of temporal parts spread across spacetime. Right now, it certainly 'feels' like I am Pierce and not just a temporal part of an object extended throughout spacetime. Both of these ways of thinking about continuants seem to be intuitive, (although inconsistent) however, the idea of being wholly present throughout one's lifetime certainly appears more intuitive and less exotic. In the following examination of three-dimensionalism, I will be drawing primarily on Sider (*Four-Dimensionalism*, pg. 63).

First let us get clear on just what a continuant is and why three-dimensionalists appeal to it. A continuant is a concrete object that persists through time, like people, asteroids, trees, and computers. Three-dimensionalists only speak of continuants being 'wholly present' at each moment of their existence because they admit that things like *events* can have temporal parts. We wouldn't want to say that World War II (an event, not a continuant) was wholly present at each moment of its existence; rather we say that it has different temporal parts, like, say, a first half and a second half. What exactly is meant by a continuant being 'wholly present' at each moment of its existence?

In a general sense the answer to this question is that for an object x, every part of x exists at t. This is problematic for the three-dimensionalist because, while 'exists at' is temporally qualified, 'part of' is not. This part of relation will change given different

times; what counts as a part of the whole will be different, thus, for the three-dimensionalist, this analysis is insufficient. Accordingly, we may try putting a temporal modifier after 'part of': everything that is part of x at t exists at t. However, such a doctrine would make three-dimensionalism a less robust doctrine. For even the four-dimensionalist who defined temporal parthood by (P@T) would admit that objects are, in this sense, wholly present at each time. Sider attempts another formulation of three-dimensionalism which he calls 'strongly wholly present:'

> (SP) x is strongly wholly present throughout interval T just in case everything that is at any time in T part of x exists and is part of x at every time in T.

While this solves the earlier problems in formulation, it also generates one. It follows from (SP) that gaining or losing parts during the interval T is impossible. Thus, most three-dimensionalists would most likely not hold (SP). This sort of formulation integrates mereological essentialism into the statement itself, something many three-dimensionalists would not accept, thus it cannot be a good formulation of three dimensionalism. Sider notes a couple other potential formulations of three-dimensionalism:

> (3D-1): It is possible that some continuant is strongly wholly present over some extended interval.
> (3D-2): Necessarily, every continuant is possibly strongly wholly present throughout some extended interval.

(3D-1) appears to be something a priori true given the picture laid out by three-dimensionalism. The problem with (3D-1) is that, while the picture of eternalism plus enduring objects seems robust, (3D-1) itself does not. It just appears too weak. It does not give us some general truth about the structure of identity through time. As a theorist

about identity through time, and time itself, one would certainly want a robust positive claim that truly captured the picture of the theory. (3D-1) just does not appear to fill that requirement.

(3D-2) stems from the three-dimensionalists rejection of temporal parts. This is not, however, the entire story. They cannot deny the possibility of temporal parts since most accept the possibility of instantaneous objects. Such objects would be temporal parts of themselves. Furthermore they cannot deny the possibility of proper temporal parts. Following Sider, imagine that by some act of miracle a lump of clay was made into a statue for an instant. Most three-dimensionalists would agree that this statue comes into being for an instant then goes out of existence. In such a case, the statue would be a proper temporal part of the lump because a proper temporal part of an object is the sum of its temporal parts and the said statue only had one temporal part. Since the primary claim of three-dimensionalism should not be inconsistent with instantaneous statues, three-dimensionalism cannot be the denial of proper temporal parts. Here the three-dimensionalist might object that the definition of temporal parts should require that temporal parts are essentially instantaneous. Given that the statue could have persisted longer than an instant, it should not be considered a temporal part of the lump. On this definition of temporal parts as essentially instantaneous, the three-dimensionalist could reject the possibility of temporal parts outright. Further, they could posit another substantive difference between the notion of perduring and enduring objects[19], namely, that essentially instantaneous temporal parts are constitutive of perduring objects, while enduring objects are capable of being strongly wholly present. This motivates the claim

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[19] Perduring and Enduring are new concepts we have not examined yet. We will examine these ideas later, but for now, Perduring means, generally, that objects have temporal parts while Enduring means that objects are wholly present.

(3D-2). This claim escapes the problems associated with (3D-1). It appears to be robust and generally applicable.

The fundamental problem with a formulation like (3D-2) though is that it still does not seem to capture the original picture of three-dimensionalism. Three-dimsionalists have a picture of continuants as being 'wholly present' throughout every moment of their existence, 'sweeping through spacetime'. This picture is focused on how objects actually exist, not how they're capable of existing. (3D-2) positions the dispute between theories of identity through time in the arena of potentiality while it should establish it in the arena of actuality. While multiple philosophers would count themselves as three-dimensionalists, D.H. Mellor and David Wiggins to name a few, a foundational thesis has been hard to come by. While three-dimensionalism may have never been stated in quite as clear and distinct a fashion as Sider has stated four-dimensionalism, this does not completely detract from it being a substantive theory. We will proceed when referring to three-dimensionalism by referring to the 'picture' of three-dimensionalism. That picture being an eternalist view of time (B-theory) in which objects are wholly present at every moment of their existence. Mellor has an intuitive example of this picture: "No one would say that only parts of Sir Edmund Hillary and Tenzing Norgay climbed only a part of Everest in 1953. The rest of us think those two whole men climbed that one whole mountain, and that all three parties were wholly present throughout every temporal part of that historic event." (*Real Time II*, 1993, pg. 86) When we refer to three-dimensionalism, we will be referring to a picture like this.

Chapter Three: Change, Instantaneous Change and Presentism

<u>McTaggart's Argument</u>

We will now turn to a different, yet related topic. The topic of change has been an area of marked importance in both physics and metaphysics. In metaphysics, three views in particular have proved themselves plausible and gained support. The perdurance theory, the relationist theory and the presentist theory have all been advanced and appear to fit nicely into the different views of time and persistence through time. While not necessary, most four-dimensionalists are also perdurantists, most three-dimensionalists are relationists, and most presentists about time (a view we will critically analyze later) are also 'presentists' about change. Before we begin, we will need to present J.M.E McTaggart's important paper on time and change (from *The Nature of Existence*, i 1921*)* as well as David Lewis's account of 'the problem of temporary intrinsics' (the problem that generates an issue with change) (from *On the Plurality of Worlds*, 1986). In this section we will also analyze the question of whether or not instantaneous change is possible.

McTaggart's paper was one of the first to attack theories of time through the medium of change. That is, he objected to theories of time given problems with the way in which they accounted for change. This strategy worked because when positing a theory of time, it seems that in doing so, one also often posits a theory of change. Of course one need not construct a theory of change for one's theory of time, but it appears that a theory

of time without a theory of change would just be incomplete, as noted in the introduction. Thus, by discrediting the two primary foundations for theories of time through their views on change, McTaggart concluded that time itself is either unreal, or it cannot consist in the ways we perceive it. That is, time may exist in some sense outside of the two primary ways we can possibly perceive it, but it most likely is simply unreal. By 'primary foundations for theories of time,' I refer to the A-theory and the B-theory, terminology we used in the section on the reduction of tense. It seems that any possible theory of time begins by accepting one of these as premises and then develops a substantive view from there which will stand opposed to a theory that accepts the opposite. To oversimplify, the A-theory is the view that the past present and future are real (the notion of 'tense' is real) and facts about whether events are past present and future are in constant flux. The B-theory is the view that all notions of past present and future or tense can be reduced to tenseless facts and relations of earlier then and later then. Accepting one of these views or a modification of one of these views from the outset seems to found of any theory of time we have spoken of.

The picture of 'change' meant here is simply the intuitive picture we have of change. Changes are things having different, often incompatible properties at different times. We observe changes every day as changes in size, shape, color, temperature, position etc. Change is usually the way we perceive temporal order. That is, the way we can tell if one event is later than another is often because of a change. The charge leveled against the B-theory by McTaggart is simply that it cannot account for change. B-facts about events are themselves permanent and unchanging and therefore can never constitute a theory of change. If there are B-facts about a certain banana, say, that it is

wholly green at 3:00pm and wholly yellow at 5:00pm, these facts always were and always will be true. These facts never change over time. Thus, according to McTaggart, the B-theory, if true, is fundamental to time, but is not, however, essential to time because it cannot account for change. The A-theory is better suited for the task because A-facts about events are constantly changing. There is a 'flow' to time, a present that is continually in flux. Thus, on the A-theory, change is, essentially, events successively becoming present. McTaggart, then, believes that the A-theory is more essential to time and so he sets out to object to the A-theory to reach his desired conclusion that time is unreal.

Arguably one of the most important pieces of McTaggart's influential paper is the charge of self-contradiction leveled against the A-theory. He begins by noting that many A-times[20] are incompatible with one another. That is, an event cannot have two of these incompatible A-times. For example, if an event has the property of being yesterday, it cannot also have the property of being tomorrow because past present and future are all incompatible. However, it appears that on the A-theory, an event is constantly changing its A-times as the present changes and thus it must have them all. Since no event can have incompatible properties at the same time, no event actually has A-times. In demonstrating this argument, I will us Mellor's notation found in his presentation of the argument in *Real Time II.*

We will let 'P,' 'N,' and 'F' represent predicates for 'is past,' 'is now' (or is present) and 'is future.' 'e' will represent any event. Thus, to say the event e is past

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[20] By A-times, I mean the times that are assumed to be essential on the A-theory, and or the times that are 'non-reducible' in the sense that we attempted in the section on the reduction of tense. These sorts of times are times that fall into the 'past present and future' categories.

present or future, we will represent these assertions with 'Pe,' 'Ne,' and 'Fe.' Complexes of these predicates will represent tensed statements. 'FPe' will represent the statement 'e will be past,' while 'FPNe,' would represent the statement 'e will have been present.' We will also evoke basic first order operators like '~' for negation, '&' for conjunction and '→' for entails. Given the A-theory, the three times 'P,' 'N,' and 'F' are mutually incompatible. It follows that Pe → ~Ne; Ne → ~Fe; Fe → ~Pe; etc. That is, if it is one of the three P, N, or F, then it is none of the other two. However, since, on the A-theory, time flows in the way it does, events appear to have all three, Pe & Ne & Fe. That is, because events are constantly changing their A-times, they must have all three incompatible times.

McTaggart's entire argument appears to turn on this point.[21] Admittedly, in both McTaggart and Mellor the explanation of why the flow of time entails an event having all three properties is never clearly stated. The closest McTaggart comes is this "If M is past, it has been present and future. If it is future, it will be present and past. If it is present, it has been future and will be past. Thus all three characteristics belong to each event." (pg. 20, ibid) So it appears that there is the claim both parties agree to that every event has one and only one of the three properties past, present and future and that the three are incompatible. McTaggart seems to assert on top of this a 'vague' fact that in some sense, due to time's flow, every event has all 3 times because he reads 'will be past' and 'has been future' as characteristics *belonging* to the event that is currently present. That is, because the present event will be past and has been future, the characteristics past and future belong to the event.

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[21] We will see later that Kit Fine has discovered a new way to reformulate McTaggart's argument that demonstrates its true importance.

Since the assertion that every event can only have one of the times and the assertion that time's flow implies that they have all 3 times seem to fall out of the very concept of the A-theory, the A-theory suffers from self-contradiction. As one might expect from such a trivially recognizable problem with the A-theory, there is a fairly obvious rejoinder. The rejoinder is that each event has these A-times *successively.* This appears correct given our *prima facie* view of the flow of time, namely, an event is and only is future for some period of time, is and only is present for an instant, and is and only is past for some period of time. No event has more than one of these properties at once. Thus, in fact, the A-theory does not entail Pe & Ne & Fe, rather it follows that e has its A-times successively. However, McTaggart has a further objection to this view.

Let's suppose that, say, Ne is true of a certain event and thus, given the said reply, e is neither Pe nor Fe. While this is true, the tensed statements that e will be past and that e was future are also true. Thus, the A-theorists explanation of the apparent contradiction, Pe & Ne & Fe, is that what in actuality is going on is, 'FPe & Ne & PFe'. While this particular statement is consistent with the mutual incompatibility of A-times, McTaggart follows this line of complex A-times to demonstrate that some combinations are in fact incompatible. For example, an event will also have the complex A-times PP, PN, FF, FN, NP, NN, and NF. More specifically, 'was past,' 'was present,' 'will be future,' 'will be present,' 'is now past,' 'is now present,' and 'is now future.' Anything that is past also was past and anything that is future also will be in the future. Furthermore, any event that has a simple A-time will also have a further complex A-time given that it has that simple time *now*. For example, if Pe → NPe; if Ne → NNe; if Fe → NFe. That is, if an event has any of the three primary A-times, it has them *now*. Moreover, if an event is past then it

also was present and was future. If an event is future then it will be present and it will be past. Thus, if Pe → PNe; if Pe → PFe; if Fe → FNe; if Fe → FPe.

Now, instead of every event having 3 simple A-times, every event has nine complex A-times. Given the flow of time, the A-times of events are always changing and therefore if an event has any of these nine complex A-times, it must have all of them. That is, McTaggart re-asserts the vague fact seamlessly to the 'next level' of complex A-times. And, as before, some of these complex A-times are incompatible. NP, NN, and NF are incompatible because they're essentially the complex versions of P, N, and F. PP and FF are incompatible because if something was past then it clearly will not be future. Of course, the A-theorist can, once again, say that the event e does not have these complex A-times all at once, but rather, successively. Or rather, the apparent contradiction on this 'second level' is explained in the 'third level' (the same strategy he used for the first contradiction). This move, however, just pushes the argument a step further because McTaggart can just re-assert the vague fact at the next level. For example PPP, NNN, and FFF will be incompatible. Consequently, if the A-theorist wishes to continue with the rejoinder that the apparent contradictions in each level are explained in the next level (successiveness), then he will embark upon an infinite regress. At first glance the regress does not appear vicious because at each 'level' McTaggart only seems to be appealing to predicates that logically follow from the predicates in the level preceding them[22]. However, since the A-theorist is explaining the contradiction at each level by an appeal to successiveness at the next level, the regress is in fact vicious.

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[22] What is meant here is that (Ne → (FPe & PFe)) & ((FPe & PFe) → (FFPe & PPFe)). In other words, the presentness of e will entail complex predicates at each level in the same sense that 'Pierce is sitting' entails 'Pierce is sitting or standing.' These complex predicates may regress to infinity, but the regress is not vicious unless of course the A-theorist is using each level to explain the contradiction in the level prior to it.

The clearest place for the A-theorist to press McTaggart's attack appears to be the vague fact we stated earlier. Here McTaggart seems to claim that 'was in the future' and 'will be in the past' imply that the characteristics of being past and future apply to an event that is present. Or in his words, these characteristics thereby *belong* to the present event. Now one might wonder how this is more intuitive than saying that the characteristics *belonged* or *will belong* to the present event. Personally, I think it would make more sense to say that the future belonged to the event that is present and the past will belong to the event that is present and I think most would agree with me. It makes more sense for the belonging to be tensed than untensed. Thus, McTaggart's characterization lacks the intuitive support this analysis retains. Since McTaggart does not appear to explain why in fact the past and future belong to the present event rather than belonged and will belong, and his analysis lacks intuitive appeal, the burden of proof is on him.

The Problem of Temporary Intrinsics & the Puzzle about Change

For the B-theorist, a serious problem still remains even though his opponent's theory of change seems susceptible to either self-contradiction or infinite regress. The charge that the very notion of change doesn't make sense given the B-theory, and thus the B-theory itself cannot account for change. B-theorists (primarily three and four-dimensionalists) have generally, in developing a theory of change to reply to this charge, also sought to reply to another objection facing *all* theories of change, namely, the problem of temporary intrinsics. Accordingly, we will now turn to this profound yet simple problem which any theory of change must account for. We will then analyze the

responses from both the three and four-dimensionalist camps. Finally we will examine the presentist reply which will motivate the presentist theory of time.

The problem of temporary intrinsics was first introduced by David Lewis in his *On the Plurality of Worlds*. For this discussion, however, I will also draw on Sider (*Four-Dimensionalism*) and primarily on Mark Hinchliff ('The Puzzle of Change,' 1996). Objects have a set of *intrinsic* properties. Intrinsic properties are properties like shape, size, color, texture, temperature, etc, properties that appear to be constitutive of the object. Intrinsic properties are to be distinguished from another sort of property we would call *relational* properties. These properties are properties that an object has because it bears a relation to another object. For example, I have the relational property of being approximately three feet from my computer screen[23]. The problem of temporary intrinsics arises when an object has different, incompatible intrinsic properties. That is, one in the same object has two different intrinsic properties that are incompatible. One of the clearest examples of this is Hinchliff's candle. Simply, the candle was straight, the candle is bent. How can one and the same object have these two obviously incompatible properties?

Before we begin to answer this question, following Hinchliff, four intuitions about change seem apparent. First, the candle persists through the change. The candle that was straight is the same candle that is now bent. The straight candle was not somehow vaporized and replaced with a qualitatively identical (except shape) bent candle instantaneously. Secondly, shape, size, color, texture, temperature etc are *properties* of the candle, not relations. While *prima facie* this intuition seems trivial, it will become

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[23] There are more types of properties like, for example, modal properties. Intrinsic and relational properties appear sufficient for the present discussion.

apparent later why it is needed. Thirdly, the candle itself has its properties. The candle itself has the property of being straight or bent, not a part of the candle. Certainly there could be a case in which part of the candle is straight and part of the candle is bent, but let us rule out this possibility now. In our example the candle itself was straight the candle itself is bent. Finally, these shapes are not compatible. If being bent and straight were compatible, then this example need not have been a case of change.

There appears to also be an intuitive, almost trivial solution to the problem of temporary intrinsics. The candle has each of these incompatible properties at different distinct times. That is, the candle does not have *both* properties at the *same* time. Thus, it seems unproblematic to simply say that a candle is straight at t_1 and one and the same candle is bent at t_2. This appears like a very simply way of accounting for one and the same object persisting through a change in incompatible shapes. While this solution seems accurate, it does not provide an account of these four intuitions about change. To truly account for this problem, we need a much more robust theory. As stated earlier, we have three major theories on this issue from the three main camps, four-dimensionalism, three-dimensionalism, and presentism.

The Perdurantist Response

The primary response given by four-dimensionalists is the *perdurance* response. According to this response, objects *perdure* through changes by having different temporal parts at distinct times. This idea fits nicely into the four-dimensionalist view, an object is its entire spacetime worm, however at any given point in time throughout its existence there is a temporal part of the object. On the perdurance view, these temporal parts have

the object's properties (i.e. bent, straight) at the instants they are instantiated. A perdurantist, then, would say that the candle has a temporal part that's straight at t_1 (to omit confusion, each temporal part will have its properties timelessly) and a different temporal part that is bent at t_2.

We used a picture commonly associated with four-dimensionalism earlier in motivating the basic idea behind the theory. This was the example of the road. We can imagine a long road, route 66 for example, which covers multiple different types of terrain. This road is analogous to an objects spacetime worm; the different types of terrain are analogous to an object's different, incompatible, properties over time. When we speak of a road like route 66 we often say things like: 'route 66 is straight and flat in the plains,' 'route 66 winds in the foothills,' 'route 66 is bumpy in the canyon' for example. Now, obviously route 66 cannot be flat and straight, windy, and bumpy (or better, straight and not straight) just like the candle cannot be straight and bent. We, however, explain away this apparent contradiction by appeal to different parts of route 66. The phrases 'in the plains,' 'in the foothills,' and 'in the canyon,' function to designate these distinct parts of route 66 such that the whole road cannot be said to have these incompatible properties.

The perdurance reply applies this picture seamlessly to the problem of temporary intrinsics. An object's different temporal parts are the primary bearers of its properties at any given time. The candle has a temporal part that is straight at t_1 and a different, later temporal part that is bent at t_2. Thus, a part of the candle is straight at t_1 and a part of the candle is bent at t_2 which means we no longer have a contradiction; the candle itself is neither straight nor bent.

While accounting for change, the perdurance theory denies one of our intuitions. Namely, the intuition that objects themselves have their properties. We believe that the object itself is the primary bearer of its intrinsic properties like shape; a part of a persisting object cannot be the bearer of *the* objects shape. Yet the perdurance theory would have us believe that it is in fact a part of the object that bears the object's intrinsic properties. Furthermore, on the perdurance theory, an object changing its shape is not an alteration from one shape to another as we might think, but rather the passage of a temporal part with the property, straight, and the generation of a temporal part with the property, bent. A perdurance theorist may try to sidestep this objection by saying the candle itself has the temporal part which has the shape, but in this case the candle still does not have its intrinsic properties *simpliciter*. And if the candle does not have its intrinsic properties then how can they change? Thus, since the perdurance theory appears to deny our intuition that objects just have their intrinsic properties and an object's parts cannot be the primary bearers of an object's intrinsic properties, the perdurance view seems unsatisfactory.

The best route for the perdurantist appears to be denying that we have such an intuition. Can a part of an object bear the objects intrinsic properties? According to four-dimensionalist metaphysics, (the metaphysics we can safely assume a perdurantist upholds) objects perdure in virtue of the fact that four-dimensionalism holds (in other words, the perdurantist theory simply couldn't be correct unless four-dimensionalism was correct). It doesn't seem like any other account of change would be consistent with four-dimensionalism except the perdurance theory. Thus, the perdurantist might say that while *prima facie* we have this intuition about objects and their intrinsic properties, upon

further inspection we find the intuition false. It must be the case, says the perdurantist, that an object's parts can bear their intrinsic properties. If they couldn't then it would follow from the fact that an object just is its spacetime worm that each object has every intrinsic property it has had throughout its history at the same time. This would result in a multiplicity of contradictions. Thus, temporal parts must be capable of bearing each object's intrinsic properties. This, of course, is a poor argumentative strategy because it begs the question to any non-four-dimensionalists. We would hope that the perdurantist can provide non-question begging reasons for why we should think that this intuition is false.

The Relativism-with-Respect-to-Change view

The next attempt at solving the dilemma of the problem of temporary intrinsics comes from the three-dimensionalist camp (primarily Mellor, *Real Time*). This theory is commonly called the *relationist* theory. On this view, objects persist in a *prima facie* more intuitive way than the perdurance theory. Here objects persist by *enduring*. That is, they exist by being wholly present at every moment of their existence. Thus, distinct from the perdurance theory, enduring objects just have their intrinsic properties, parts of them do not. The relationist theory, then, avoids the objection the perdurance theory suffers. However, in order to escape the contradiction of an object having incompatible intrinsic properties, relationists, in short, define properties as relations. That is, every property becomes a relation between an object and a time. Thus, when we say the candle is straight at t, 'straight-at' becomes a relation between the candle and t. Since distinguishing properties at different times is how we talk about change, every property,

on the relationist view, just is a relation. Thus there is no 'being straight' or 'being bent' only 'being straight-at' or 'being bent-at'.

As we saw, the relationist theory is able to meet the objection leveled against the perdurance theory, objects have their properties *simpliciter*. However, the relationist theory denies a different intuition we laid out earlier. That is, it denies the intuition that properties are in fact properties and, rather, it reduces properties to relations. Thus, it is not that objects have their properties *simpliciter*, but rather that objects have their relations *simpliciter*. While the relationist strategy easily solves the problem, it denies perhaps one of our most basic intuitions that properties are, in fact, properties. This is the intuition that appeared so trivial it didn't seem worth mentioning. Further it just seems absurd to call 'shape' or 'color' a relation rather than a property. Some relationists try to avoid this consequence by developing 'relativised properties.' I will not look into the theory fully here, but note that it still has the consequence that shapes cannot just have their properties. Properties do not remain one-placed as we expect them too. Thus, it still ends up denying the intuition that properties just are properties. As Hinchliff states, "[relativised properties] are nothing new; they are relations in disguise" (pg. 122, ibid).

As noted throughout, four and three-dimensionalists hold similar views with respect to the reduction of tense. That is, they both stem from the B-theorist and or eternalist camp. On both views, all times are equally real and no times are metaphysically distinguished from any others; hence the absence of a past present or future. Hinchliff believes it is this foundation that causes these theories to run awry when put to the test with respect to change. The key idea is that when we say 'the candle is straight at t,' 't' is not unique in any way given eternalism. In designating any distinct times like 't_1' or 't_2'

or 't₃' there is nothing special about any of these times. All are as equally real and existent as any others. Since no time is metaphysically distinguished, say, by calling one time 'present,' objects just have all their properties at any time. And this, simply, is a contradiction. If objects are to just have their properties, then the candle is both straight and bent on the eternalist view. The time when it is straight and the time when it is bent are both equally real and existent. Thus any theory presupposing eternalism has to deny either that shapes are properties (and instead relations) or that the candle itself just has its properties. And to do this is to deny fundamental intuitions we have about objects and their properties. Thus, we must look for a new way to account for change, which will then color our theory of time. The first step at doing this appears to be the denial of eternalism, the cause of the contradiction.

The Presentist Reply

The next most plausible picture of time and change seems to be that of *presentism*. And indeed, Hinchliff himself, as a presentist, uses the above arguments as motivation for presentism. The presentist picture is simply this[24]: the only things that exist are the things that presently exist. Those times that we would call past and those times that we would call future are unreal and non-existant. Thus, as the 'present moment' sweeps along from the past to the future, the only things that exist are the things that exist during a given moment for the instant that it is present. *Prima facie* one immediately concludes from this picture that we cannot refer to past or future objects. And it's obviously true that we can refer to past and future objects. The candle is a good

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[24] I will analyze the presentist doctrine in greater detail in further sections. Right now the picture of presentism in tandem with the account of change it generates is all that is necessary.

example: take the candle that is now bent; one and the same candle was straight in the past. But if things in the past are unreal and non-existent how can we successfully refer to them in the present? To tackle this question, the presentist treats the past and future tenses, the tenses that we use to talk about events in the past and future, as sentential operators with meanings that are given by certain rules. These sentential operators for tense are meant to act like the negation operator. One of the virtues of the negation operator is that it does not require us to posit a realm of non-being because its meaning is given by a rule absent of such a realm. That is, for a statement like 'the candle is not straight,' we do not need to say something like 'in the realm of non-being, the candle is straight' to successfully refer to the candle that is not straight. Similarly for the presentist, the past tense would have a rule like the following: 'It was the case that S' is true if and only if it was the case that 'S' is true.' And for the future tense: 'It will be the case that S' is true if and only if it will be the case that 'S' is true. With these rules, the presentist can accurately refer to future and past objects without positing a 'realm of the past,' or 'realm of the future'.[25]

So what then is the account of change on the presentist picture? The presentist appeals to facts that obtain about the object in the present moment. Thus, when speaking of the change that occurred in the candle the presentist would say:

The candle *was* straight.
The candle *is* bent.

Both of these facts about the candle obtain in the present moment. These facts are all that is needed to express the change in the candle; they contain the differing

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[25] The presentists tense operators will be revisited in future sections and considered in more detail.

incompatible shapes that the candle had and has. As one can easily see, the true beauty of this view is that the temporal modifier can be completely dropped. That is, the 'at t' which is a primary source of the problems suffered by the other two views is no longer needed on the presentist view. Why? A certain time has been metaphysically distinguished from all others, namely, the present. Thus all time distinctions can be made in terms of the present, the candle was straight because it was straight before the present moment, the candle is bent because it is bent in the present moment. A reference to 'at t' need not be made. As such, the presentist can account for our four intuitions about change. The candle persists through the change by enduring, it is wholly present throughout the change, second, the candle can just have its properties, not have them in relation to a time, third, since the candle endures, the candle itself has its properties, not derivatively through a part of the candle, and fourth, the presentist upholds our intuition that the shapes are incompatible, the candle cannot have both shapes at the same time.

Thus, it appears that the presentist can better account for our intuitions about change than the other two major theories of time and change. While it now seems appropriate to move into thorough analysis of presentism since we have some motivation for the theory, I would like to put that off for a bit and digress into another major issue concerning change. Namely, the issue of instantaneous change.

Instantaneous Change

When theorizing about change, one question that is often overlooked is the question of instantaneous change. Can changes occur instantaneously? By change we mean an entity being in a different state at a certain time than it was at the time previous.

Often, this entails one of its relational or intrinsic properties being different from what it had been. By instantaneous, we mean a change occurring in the entity that requires no time duration. No duration of time must pass for the change to occur. Thus at one instant, for example, an object x has the property F and at 'the next instant' one and the same object has the property not-F. From an intuitive, pre-theoretic standpoint, we believe that such change is impossible. The changes that we experience in our variegated environment largely appear to require some duration of time. A person going from sitting to not sitting, a marble going from position A to position B, a candle going from being straight to being not straight, presumably, in all these cases and cases like them, *some* amount of time passes for the change to occur. However, our a priori reasoning seems to lead us to the exactly opposite conclusion. Not only is it not that case that no instantaneous change occurs, but *a fortiori* every case of change is instantaneous.

In using the phrase 'the next instant' here, one might think that I'm assuming a view about the structure of time, namely that time is discrete. The core idea of this view is that for any instant of time there is a 'next instant'. Here there is a 'smallest unit of time' such that if one of those times exists, t_1, then there exists a next time, t_2. There is no time in-between those two times, t_1 and t_2. This view of time's structure is often opposed to another view, namely that time is dense. Here, for any two instants of time, t_1 and t_2 there is always an instant in-between. Thus, we could never conclude that t_2 is 'the next instant' because there is always some unit of time in-between t_1 and t_2. On the dense view, then, there is never a halting point on how small units of time can be sliced down. Analogously to the real numbers, where for any two reals there is always a real number in-between, time has a structure like this. It must be noted that the problem of

instantaneous change occurs on either view of time's structure. If time is discrete, it is fairly obvious: one instant x is F, and the next instant x is not-F, the change occurs instantaneously. If time is dense, then there must be a last moment when x is F, or a first moment when x is not-F. If x must be F up until that last moment, then the change to not-F occurs instantaneously. So it seems that the problem of instantaneous change is independent of these two views of time.

We are led to the conclusion of instantaneous change by the law of excluded middle. This platitude states that for any object x and any time t, either x is F at t or x is not-F at t. Such a law appears to be a logical truth. For what else could an object be other than F or not-F? It follows from this that even when an object is undergoing a change, say from F to not-F, it must be in one of those two states at all times. But then how can there be a period of time when it's 'changing'? It seems that such a period of time would require a 'grey state' where it is indeterminate whether x is F or not-F. However, if we were postulate this, then we would have to deny the law of excluded middle. The picture we've created looks like this:

Law of excluded middle: $\forall x \forall t(Fx$ at t v $\sim Fx$ at $t)$.
Consider an object x changing from F to not-F from t_1 to t_5:

Fx   ~Fx

t_1…………………t_2………………..t_3………………..t_4………………..t_5

Given the law of excluded middle, x must be F or not-F at every moment of this transition. Thus for any time t arbitrarily close to time t5 x is going to be F. Consequently, x must be F up until t5 when x becomes not-F (again this holds for either

view of the structure of time). Given this picture, *all* changes occur instantaneously. But this appears to contrast markedly with our intuitions. When I go from sitting to not sitting, the change in my shape definitely does not occur instantaneously. However, many theories that attempt to formalize the notion of 'x is F at t' and notions like it bite the instantaneous change bullet. Take, for example, a relationist theory, which basically says that x's being F is a relation between x and t. This can be represented as F(x, t). Given this account of 'x is F at t,' can x be anything other than Fx or ~Fx and still remain consistent with the law of excluded middle? One way we can analyze this is how an account of 'x is F at t' deals with the negation operator and its scope. How would we formalize, on the relationist view, not: x is F at t? The correct answer appears to be ~F(x, t). Similarly for x is not-F at t. The answer again seems to be ~F(x, t). Thus the relationist view is consistent with the law of excluded middle: $\forall x \forall t (F(x, t)$ or $\sim F(x, t))$. On this view, an object can be nothing other than F(x, t) or ~F(x, t) (it also cannot be both). This, of course, entails the counter-intuitive result that all change is instantaneous. There is no time period in which (x, t) is 'changing' in which it is neither F or ~F, rather at all times, (x, t) is either F or ~F.

Here it is worth noting in passing that Quine's account of 'x is F at t,' stated earlier, is quite similar to the relationist account. The relation on his view is between a temporally extended worm and a three-dimensional cross section of the universe; where they intersect given an instant. The primary difference between the two views is that Quinean properties are properties while relationist properties are relations. However, while the nuances multiply on Quine's view, I am confident that it entails the counter-

intuitive result that all change is instantaneous. Thus, the primary charge leveled against

the relationist view can also be leveled against the Quinean view.

Accordingly, one can either bite the bullet and accept that all change is

instantaneous, or one must search for an account of 'x is F at t' consistent with the law of

excluded middle that allows for a state in which x is neither F or ~F. While such an

account seems almost impossible, Arthur Prior produced something like it in his *Papers*

on Time and Tense. This view I will refer to as the 'operator view' [26.]

The name 'operator account' seems appropriate to the view because the phrase 'at

t' acts as a sentential operator. As such, the sentence 'x is F at t' would be represented, on

this view, as At t: Fx. This account seems a bit more intuitive than then relationist view

because having the temporal modifer 'at t' operate on 'Fx' places a sort of importance on

it that seems agreeable upon reflection. For when we inquire about 'x is F at t,' it is

precisely that very time that we're worried about and in this sense that time should

operate on Fx. When we analyze how this account is formally similar to other cases of

'representation,' as Quine would call them, this point may be more clear. Here are some

grammatically similar examples, 'according to the Da Vinci Code: Jesus had a wife.'

Here the representational entity (a book) is operating upon the point being made because

that point is found within the book just like Fx is found at that time. 'In Pierce's opinion:

Reed should have a football team,' is another good example of this form. Pierce's opinion

operates upon 'Reed should have a football team' because that is the content found at

Pierce's opinion. In this sense At t: Fx appears to be good way of formalizing 'x is F at t.'

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[26] The operator syntax is a 'general view' of Prior's he develops over many papers. Perhaps the best place to find one of his discussions of it would be his paper 'Tense Logic for Non-Permanent Existences' found in *Papers on Time and Tense*.

For 'not: x is F at t' we would get ~(At t: Fx) and finally for 'x is not-F at t' we would get

At t: ~Fx. Let us summarize the ground we've covered:

	Neutral Language	**Relationist**	**Operator**
(1)	x is F at t	F(x, t)	At t: Fx
(2)	not: x is F at t	~F(x, t)	~(At t: Fx)
(3)	x is not-F at t	~F(x, t)	At t: ~Fx

As you can see, on the relationist view, if we attempt to produce an instance of

something being neither F nor ~F, we either violate the law of excluded middle, or we

create a contradiction. Thus, a proponent of the relationist view must bite the bullet and

assert that all changes occur instantaneously. However, on the operator view, while (1)

and (2) are obviously contradictory, (1) and (3) are not obviously contradictory. Thus, it

would be possible to say that there exists an x and there exists a t such that At t: Fx and

At t: ~Fx, or ∃x∃t(At t: Fx & At t: ~Fx). This move gives us the logical room to develop

a state in which an entity could 'change' from being F to ~F, and this change could occur

over a period of time. Further, this account is still consistent with the law of excluded

middle. An object could be in state (1) or (2), but not both. Given this framework, a

proponent could assert the law of excluded middle, but also deny that changes occur

instantaneously. Such a view would accord with our intuitions about excluded middle and

change much better than the relationist view.

To step aside for a moment, it doesn't seem that the operator account can be used for all superficially similar forms. There are forms closely related to the form 'x is F at t,' that require an account like relationism or Quine's to be intelligible. Take for example 'Pierce is sitting next to Paul'. We certainly would not want to use the operator account and say that this should be understood as, at Paul: Pierce is sitting. Pierce is not 'at Paul' on any intuitive understanding of 'at'. Something like the relationist's logical form is better suited for cases like these. Thus the operator account may only apply to cases of property ascription at a time.

At this juncture, an objection might be raised about (2) and (3). Some may say that (2) and (3) are equivalent on the operator view. If (2) and (3) are equivalent, then this view generates a contradiction just like the relationist view. Indeed Prior himself believes that (2) and (3) are equivalent in all cases except when we speak of past objects that do not exist in the present moment. This conjecture is of course a result of Prior's acceptance of the presentist thesis that only present entities exist. For example if we apply (2) to the statement 'Socrates is sitting now,' we get a truth, namely, ~(at now: Socrates is sitting). However, if we apply (3) we get a falsehood: at now: ~(Socrates is sitting). On the presentist view, in the present moment there is no such entity 'Socrates' whose properties we can speculate about. The reason the former is acceptable, on the presentist thesis, is because we negate the entire sentence (in the de dicto sense) and need not postulate that there is an existent entity 'Socrates' (in the de re sense) that is failing to sit. Thus, when speaking about non-existent objects on the presentist view, (2) and (3) come apart. However, aside from this, Prior takes (2) and (3) to be equivalent. As shown earlier, if (2)

and (3) are equivalent in the case of 'x is F at t,' then the conclusion that change is

instantaneous is forced upon us. Why take (2) and (3) to be equivalent?

Take, for example, the statement 'in Australia it is not summer in June.' Using an

operator account we would analyze this as something of the form of (3): 'in Australia:

not(summer is in June).' How does the sentence look when analyzed with something of

the form of (2)? 'not(in Australia: summer is in June).' Intuitively we conclude that,

relative to this example, the result given by (3) entails the result given by (2) and vice

versa. 'It is not the case that in this room there is a pink elephant' seems to be equivalent

to 'in this room it is not the case that there is a pink elephant.' In these cases the

placement of the negation operator makes no substantial difference either before the

sentential operator or before the statement. In this sense, then, the placement of the

negation operator will not change the truth value of the sentence and thus (2) and (3) are

equivalent. Furthermore, a restrictor analysis can be given of these examples

demonstrating their equivalence. This analysis 'reduces' the operator account such that

'in this room' or 'in Australia' are no longer sentential operators, but rather relations

quantified into for the intended effect of restricting the quantifier(much like the relationist

account). Let us formalize the pink elephant example where r is this room, P is the

predicate 'is pink' and E is the predicate 'is an elephant.' Given the operator account, we

might say:

(A) in r: $\sim(\exists x(Px \& Ex)) \leftrightarrow \sim(\text{in r: } \exists x(Px \& Ex))$[27]

Given the restrictor analysis we would rewrite this as:

(B) $\sim\exists x(\text{in}(x, r) \& Ex \& Px) \leftrightarrow \sim\exists x(\text{in}(x, r) \& Ex \& Px)$

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[27] These are examples of (2) and (3) on the operator account.

(B) is obviously true.

There is, however, something that distinguishes these cases from the cases in which we are interested. The cases just examined are cases dealing specifically with locations. In examples of the form 'x is F at l' where l is a location, (2) and (3) appear to be equivalent on the operator account. Given the plausible assumption that 'x is F at t,' where t is a time, is fundamentally different from 'x is F at l' where l is a location then we can easily distinguish between cases apparently equivalent and cases apparently not equivalent.[28] If Prior is warranted in claiming that in cases of property ascription to non-existent objects, (2) and (3) come apart, then why aren't we are warranted in claiming that in other cases involving temporal modifiers, (2) and (3) come apart? How would this be cashed out? As shown in the example of Socrates sitting, the truth of the sentence seems to be sensitive to the scope of the negation operator. When it is placed before the proposition, and appears to be 'of the proposition' (in the de dicto sense) it may return different truth values than if it is placed within the proposition and appears to be 'of the thing' (in the de re sense). This analysis is easily extended to 'x is F at t'. In this sense, (2) and (3) need not be equivalent in cases where 'x is F at t' is used and variations therein.

With the apparatus in place that has given us the logical maneuverability to be consistent with the law of excluded middle and posit a '3rd state' other than Fx and ~Fx, we now need a metaphysics on top of it. I do not expect to cash out the sort of

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[28] This relates to Quine's treatment of time. Quine and four-dimensionalists generally like to treat time as if it existed similarly to a spatial dimension. Thus it makes sense why four-dimensionalists like the Quinean view of 'x is F at t,' and would certainly think that (2) and (3) are equivalent. They would not believe there to be a fundamental difference between 'x is F at t' and 'x is F at l.'

metaphysics this would require in full, rather, perhaps lay some of the preliminaries. Let us examine again our previous picture:

Consider an object x changing from F to not-F from t_1 to t_5:

Fx   ~Fx

t_1…………………t_2………………..t_3………………..t_4………………..t_5

On this account, Fx is 'changing' to ~Fx from times (t_1, t_5).[29] During this time, x is neither wholly F nor wholly ~F. While this sounds a little peculiar on paper, it fits perfectly with our intuitions. Let us imagine a case that fits with Fx and ~Fx. We believe that I go from being a child to not being a child as I mature into my adolescent years. On the relationist or Quinean accounts, I am a child at every point of time arbitrarily close to my not being a child until, at one instant, I am a child and at the very next instant I am not a child (or if time is dense, there is a last moment I am a child or a first moment I am not a child). This appears unintuitive. It seems rather that my losing the property of being a child requires a period of time. It is not at all clear how one might define not being a child; however the details of that definition are irrelevant. Presumably I have to act and behave in certain ways that I did not previously employ. My going from acting and behaving childishly to acting and behaving non-childishly does not occur instantaneously as the relationist and Quine would have us believe. Instead I change from acting and behaving childishly to acting and behaving non-childishly over a period of time.

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[29] The parentheses here are denoting mathematical notation. (t_1, t_5) is an open interval in which t_1 and t_5 are the endpoints, but not included in the interval.

In formalizing this picture we assert: ∃x∃t(~(at t: Fx) & ~(at t: ~Fx)). Intuitively, there exists an entity x and there exists a time t such that it is not the case at t that x is F and it is not the case at t that x is not-F. Again, this does not contradict the law of excluded middle because we can state it clearly: ∀x∀t(at t: Fx v ~(at t: Fx)). This raises some essential questions: what really do we mean by 'changing'? And what else needs to be said about this 3rd state?

We might attempt to define changing as:

(C): x is changing during interval T just in case one of x's properties before T will be different after T

This definition seems to capture the framework that has been laid out. Changing entails an interval between two different properties such that during the interval and object has neither of the properties. A clear statement of this account or the 'change thesis' would assert:

(CT): If for some interval T x is F during T and for some other interval T´ x is not-F during T´, then there is an interval between T and T´ such that x is neither F nor not-F, but is rather changing from F to not-F.

On this view, it seems that changing-from-F-to-not-F is a property of x for some time interval. Assuming that we can make sense of such a property, then this view appears to be tenable. Again, I believe such a property can be intuitive. When I go from being a child to not being a child, there is an interval of time in between these properties such that I am changing from being a child to not being a child. Often times the changes can be characterized. In this case specifically the changing can be characterized by contingent features about me (to take one for example, I begin taking responsibility for

my school work). However, we can imagine that there are cases in which an object changes from F to not-F and it has the property changing-from-F-to-not-F for a time interval. Thus, this view would have to postulate such a property. At the very least, what we have accomplished is a '3rd state' that is not ruled out by logic alone. This 3rd state could allow us to rid ourselves of the counter intuitive idea of instantaneous change.

Presentism

Presentist Motivations

The doctrine of presentism has been mentioned much throughout this piece already, without extended detail. St. Augustine may have been one of the earliest presentists. In his *Confessions*, Augustine analyzes some of the basic intuitions a critical thinker might have about time:

> "If future and past events exist, I want to know where they are. If I have not the strength to discover the answer, at least I know that wherever they are, they are not there as future or past, but as present. For there also they are future, they will not yet be there. If there also they are past, they are no longer there. Therefore wherever they are, whatever they are, they do not exist except in the present." (pg. 233-34)

Here Augustine considers the basic intuition that that which is not yet and that which is no longer cannot exist. The present just 'is' and thus is the only time that actually exists. This picture has been the guiding light for presentists since his time. A statement of the presentist's thesis might be: That which exists is that which is present. Given this intuition, this statement appears compelling. Furthermore, as a general thesis for the position, this thesis appears to be evidenced by our everyday sense experiences[30]

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[30] What I mean here is essentially the idea of 'the necessary presence of experience' which we discussed in the section on the reduction of tense.

whereas the thesis commonly given by a three or four dimensionalist, namely, the thesis that all times exist, appears less evident in light of our our sense experiences. Our conscious activity, our direct sense impressions, our most visceral experiences occur in the present, they do not occur in the past or the future. And what can we be more certain of a posteriori than our direct sense impressions? Setting aside worries generated in epistemology, we can be certain that our direct sense impressions are impressions of objects that exist. Given that these direct sense impressions occur in the present then the statement that all that exists is present seems supported by our direct sense impressions. Our old sense impressions of objects which can only be accessed memorially seem less certain then present sense impressions of objects (subject to more criticism by epistemology). These are derivatively experienced through the memory function of the brain which is, traditionally, less trustworthy than the sense-perceiving centers. Whether or not these memories are of existing objects could be more readily doubtable than sense-perceptions. Further the sense impressions contained in these memories are 'no more' in the sense that they are not 'right now.' Perhaps those past objects do not exist because they are no longer. The past is no longer and the future is not yet, thus, only presently existing objects exist. These intuitions provide some of the leading motivation for the doctrine. Presentism also provides the best solution to the problem of temporary intrinsics, one that preserves our four primary intuitions about change.

As compelling as these motivations are, presentism is also a rather peculiar doctrine. It seems odd to hold that the past and future have no sort of existence. Past objects also appear to exist: we can point to their place in time 'where' they exist. Depending on one's views of determinism future objects exist. Consider a ball rolling at a

constant velocity in a laboratory environment. Our physical laws can determine the ball's position to a high degree of accuracy a second after the location it currently resides in. In this deterministic sense, the ball could be said to exist at a future time. Furthermore, the notion of the present as an entity seems incomprehensible. For example, one might ask the presentist: 'given that the present is the only time in which things exist, an important question we might ask is how long the present is? Or how much time elapses in the present moment'? Presentists often reply to this by saying 'the present is an infinitely short period of time'. This answer seems unsatisfactory for a number of reasons. Firstly making sense of what an infinitely short period of time is appears to be a daunting task. When we contemplate a 'period of time' we imagine a duration and when we imagine a duration, an infinitely short duration does not seem appropriate. The concept of a duration appears to imply a greater-than-zero value. Further, on the presentist view, what exists exists in a constant succession of infinitely short periods of time. One might wonder how these moments succeed if they have no duration at all, or how change itself could occur when no duration of time really passes. While these are not substantive objections, but rather mere worries, I hope that the presentist would have a simple and clear answer for them. We will now, however, turn to more robust objections to presentism. We will primarily be drawing on Sider's *Four-Dimensionalism* in our analysis of the main objections to presentism.

The Cross-Time Relations Objection

Similar to four and three dimensionalism, much of the presentist doctrine simply falls out of their view of tense. A popular slogan often referenced is that presentists 'take

tense seriously'. From these statements alone it is fairly clear that presentists reject the reduction of tense. They take tense-words as primitives that are irreducible, like *was* and *will*. Thus, to speak of past or future objects, presentists take facts that obtain in the present and combine them with sentential operators, WAS or WILL to produce true sentences about the past or future that don't commit them ontologically. For example, the statement 'there existed Cro-Magnons,' when represented in logic, would commonly begin with an existential quantifier '∃x' which is ontologically committing. The presentist on the other hand will express this statement as:

1.) WAS(there exist Cro-Magnons)

This says something true about the past, but does not commit one to the existence of Cro-Magnons (existential quantification within the scope of the WAS operator is not ontologically committing)[31]. Similarly for the future tense, consider the statement, 'there will be a female president.' A presentist would represent this as:

2.) WILL(there is a female president)

Using this strategy, presentists can successfully speak of past and future events without being committed to their existence.

Thus presentism also seems to be the denial of eternalism. Presentists deny the reduction of tense and metaphysically distinguish the present from all other times (although on their view no other times exist). Their primary thesis is that all things that

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[31] This strategy is very similar to the actualism/possibilism dispute in metaphysics. Here a possibilist will analyze a modal claim like ◊(santa claus exists) by quantifying over possibilia, 'santa claus exists in some possible world.' The analogue to this would be the three or four dimensionalist quantifying over past objects and saying 'Cro-Magnons exist at some past time.' Actualists agree to the truth of the modal claim while denying possible santa claus's. In a similar vein, presentists admit the truth of 'there existed Cro-Magnons' while denying that Cro-Magnons exist (at some other time).

exist presently exist. We will now look at some objections typically given against presentism.

The first objection we will examine is the objection involving cross-time relations (from Sider, *Four-Dimensionalism*). More specifically, when we relate two entities which never shared a present moment together, presentism appears to run into problems. Sider's example is that of an American philosopher admiring a Greek philosopher. To represent this statement in a presentist style we would first need a fitting present tense sentence:

1.) ∃x∃y(x is an American philosopher, & y is an ancient Greek philosopher, & x admires y)

This sentence is clearly false. Since there have been American philosophers, no ancient Greek philosophers existed. Thus, we attach a WAS operator to the sentence:

2.) WAS: ∃x∃y (x is an American philosopher, and y is an ancient Greek philosopher, and x admires y)

This, of course, does not work either because no ancient Greek philosophers existed when American philosophers existed. Accordingly, we might try embedding the tense operator:

3.) ∃x[x is an American philosopher, and WAS: ∃y(y is an ancient Greek philosopher and x admires y)].

Prima facie this appears to solve the problem. Since the tense operator is embedded within the sentence, the quantifier over American philosophers is not within it. Thus, only the ancient Greek philosopher is considered 'in the past.' However, 'x admires y' is also within the scope of the WAS operator. This means that the slice of past time

WAS is pointing too (when y is an ancient Greek philosopher) is also the time the

admiration is occurring. The admiration, clearly, is not something that occurs in the past,

rather, it appears to be a relation about two times at once. Relations that require relating

two distinct times at once seem to create problems for the presentist.

Following Sider, a presentist might attribute this cross-time relation problem to

the use of what one might call 'slice-operators.' Essentially what is meant by this phrase

is that when we use a WAS or WILL operator we point to a 'slice of the past' or a single

instant. A presentist might think that if we were to employ 'span-operators,' we might get

the correct result in this case and cases like it. Surely enough, if the span operator were to

cover the time from the ancient Greek philosophers to the admiration from the American

philosopher, the problem would be solved. However, Span operators appear to be at odds

with the very doctrine of presentism itself. Presentists maintain that, of course, it has

always been the case that only present objects exist, or more succinctly, necessarily, only

present objects exist. The use of span operators would imply that two things that might

not have ever shared a present moment together could exist. For example, WAS $\exists x \exists y($ x

= Nietzsche & y = Kripke) would be a true sentence because '$\exists x \exists y($ x = Nietzsche & y =

Kripke)' is true in assorted spans of past-time. However, the sentence '$\exists x \exists y($ x =

Nietzsche & y = Kripke)' can never be true under presentist doctrine because Nietzsche

and Kripke never shared a moment of present existence and non-present things cannot

exist.[32] We will now look at the truth maker objection.

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[32] It is worth noting that the problem posed by cross time relations to the presentist can be solved by the acceptance of Newtonian substantival space which involves the use of enduring places. Newtonian space, however, is for the most part a scientifically revisionary theory – it stands opposed to the almost unanimously accepted Minkowski spacetime. Fully analyzing this solution would take us too far afield, however, Sider does so on pages 28-35 of his *Four-Dimensionalism*.

The Truth Maker Objection

When we speak of a 'truth' we often believe that there exists something that grounds the truth we're speaking of; we would like to point at the thing that *makes* what we're speaking of true. In this sense, the entity that grounds our truth is its *truth-maker*. Thus a clear statement of the position might be: For every truth, T, there exists and entity whose existence suffices for the truth of T. Typically the truth making entity is referred to as a certain 'state of affairs,' or a 'fact'. These are considered concrete constituents of the world. As with virtually all metaphysical theories there are worries raised against the existence of truth-makers. More specifically in the case of negative existentials, truth makers appear to fail. Take for example 'there is no Santa Claus.' This statement, while true, clearly has no truth-maker that is a concrete constituent of the world. In contrast 'there exists a rock' appears to clearly have an entity that suffices for its truth. For any rock, r, the very fact that r exists seems to ground the truth, 'there exists a rock.' 'r' is a truth-maker for this statement. It would be hard to imagine a state of affairs in the actual world which entails that there is no Santa Claus. At least there wouldn't be a concrete constituent of the world that entailed this truth.

To circumvent this worry, metaphysicians (Bigelow, Lewis) modified the truth-maker principle to state that *truth is supervenient on being*. In other words, what is true supervenes on the objects that exist, the properties they instantiate and the relations they stand in. This method of arriving at a truth-maker principle allows us to dodge the worry that 'there is no Santa Claus' lacks a truth-maker. When formulated this way, if a statement has a truth value in the actual world, it will retain the same truth value in a world in which the same objects exist, instantiate the same properties and stand in the

same relations. Thus, 'there is no Santa Claus' will be true given a sufficiently similar world to ours. Accordingly, some negative existentials do not necessarily need facts to make them true, and the truth-maker principle can remain plausible given this formulation.

At any rate, the purpose of the truth-maker principle is to rule out metaphysical theories that include ungrounded truths. As Sider puts it, truths that 'float free' of the world. One might think that when presentists posit truths about the past, they are asserting a statement that has no truth-maker nor do they supervene on being. These truths seem to, indeed, float free of the world. Given that only presently existing objects exist, only presently instantiated properties are instantiated and only presently existing relations between objects obtain, any statement about the past does not supervene on being.

Presentists have attempted to account for this problem, most notably John Bigelow. In order to make the truth-maker principle consistent with presentism, Bigelow asserts that the world has properties like *previously containing Woolly Mammoths* (from Sider, *Four-Dimensionalism*, 2003, pg 37). In fact, at any given present moment, the world instantiates properties such as previously containing all the objects of the past, all the properties they instantiated and all the relations they stood in. Thus, when a presentist uses a tensed sentence, truth still supervenes on being because the world contains all the necessary properties of the past in the present moment. While this disolves the problem for the presentist, we may wonder whether such a move is allowable.[33]

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[33] It is worth noting here that the presentist might try other methods. A presentist might say that the presently existing state of the world (objects, their properties and relations) in tandem with the laws of nature ground tensed truths about the past. In other words, these past truths are entailed by the present state of affairs plus the laws. While this method is not only exceptionally metaphysically exotic (laws going in a

As noted previously, the main function of the truth-maker principle is to rule out dubitable metaphysical theories. While the Bigelow dodge works, it appears to create another, perhaps increasingly dubitable metaphysical theory. In metaphysics particularly, the more mysterious the theory the more reason one has to doubt it. Sider catalogues many of the dubious metaphysical theories: brute dispositions, brute counterfactuals, brute 'properties' concerning laws of nature, to name a few. All of these are said to 'cheat' in some way (most often by positing something that is true, but ungrounded). Bigelow's way of avoiding the truth-maker objection is not only mysterious, but also seems to cheat much like these other theories which gives us good reason to doubt it. Thus presentists seem unable to account for truth makers that ground both past and future truths.

The Special Relativity Objection

A Sketch of Einstein's Theory of Special Relativity

The final, and traditionally strongest objection against presentism is its inconsistency with special relativity. The foundation of presentism – the metaphysically distinguished present, has no sort of observer-independent existence in the almost unanimously accepted Minkowski spacetime. The simultaneity of events is all relative to the motion of the observer. Presentists, however, appear to need a sweeping present moment – a moment that can be said to house all that exists in the world. In special

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backwards direction), it has a serious problem. If the laws of nature are to ground tensed facts then they themselves cannot be grounded in tensed facts – the very facts we use to ground the regularities that make up the laws of nature.

relativity, the 'present' for an observer walking at a constant velocity on the sidewalk is going to be different from an observer on a rocket accelerating into space. *Prima facie,* presentism has no way to account for these differing 'present' moments[34]. Thus, from the outset, presentism is at odds with contemporary scientific theory. Now many presentists have accepted this fact and affirmed that their theory is scientifically revisionary with acquiescence. We would hope, however, that having one's metaphysics agree with contemporary physics be a general principle metaphysicians adhere too.

I will now digress somewhat to explain special relativity in some detail. While this explanation will lack a high level of rigor, it is meant to get the picture of the theory across while also laying the foundation for our objections to presentism. I will be drawing from Brian Greene's discussion of Special Relativity in his *Fabric of the Cosmos* in this sketch of Special Relativity.

Einstein's theory of Special Relativity was founded on his ideas about the essential nature of light. Light is something that travels at such an incredible rate we are virtually unable to see it 'move' in everyday life. One might wonder though, if one was able to travel at the same speed as a light ray, would the light ray appear stationary? What would that look like? In dealing with questions like this and having Maxwell's equations already available, Einstein discovered that the speed of light *is* 670 million mph[35]. The emphasis is placed on the 'is' because a light ray will move at 670,000,000 mph relative to any frame of reference. We will define a general notion of inertial frame of reference as a specific perspective that observations of the world can be made from. The technical

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[34] I put 'present' in scare quotes in relation to special relativity because there is no notion of a universal present in it. In other words, the word 'present' is essentially meaningless in a Minkowski spacetime setting (besides of course, present relative to a frame of reference).
[35] The details of how he arrived at this conclusion are irrelevant to our present purposes.

definition defines inertial frame of reference as a set of axes from which an observer can measure the position and motion of events. Since the speed of light is constant in all frames of reference, if an observer is moving at any speed up to 670 million mph next to a light ray, the light ray will still appear to move away from him at 670 million mph. Thus, no matter what an observer's state of motion is, the speed of light remains constant. Since the speed of light is constant in any frame of reference, Einstein concluded, our traditional conceptions of space and time must not be correct. This led him to develop his special and general theories of relativity.

Given that the speed of light is constant in every inertial frame of reference, Einstein proposed that space and time must be relative in some respect. Space and time must be different given differing frames of reference. Space and time cannot be absolute alongside the speed of light. This means that given two frames of reference with different speeds, time elapses in either frame of reference at different rates, so to speak. The faster a frame x is moving relative to a frame y, the slower time elapses in x relative to y. Similarly, for space, an object's length will contract in the direction of its motion from the point of view of another frame in which the object is moving. Distances measured between two specified events will be different given different moving observers. If space and time did not behave like this, then the speed of light could not remain constant. Space and time appear to adjust to moving observers so that the speed of light can remain constant.

One way to conceptualize these breakthroughs is that while we are aware of objects moving through space, objects move through time in an analogous and complementary manner. Traditionally, time was thought of as independent of one's

motion. Time flowed unconditionally. However, as Einstein asserted, time and one's

motion are closely intertwined. One way to think of it is that when an object is at rest

relative to a frame of reference, it is 'moving entirely through time' (relative to that

frame). When it begins to move spatially, some of its motion through time is 'diverted'

into motion through space. In this sense, when the motion is diverted, time elapses more

slowly.

To relate this back to the absolute speed of light we might say that for any object

x, x's speed through space combined with x's 'speed' through time is exactly equal to the

speed of light. While this seems peculiar at first because, presumably, nothing can travel

at the speed of light, it must be noted that we are talking about something more robust

than *motion through space*. This is the idea of motion through space *and time* which, as

Einstein revealed, are always complementary. One easy way to think about this is when

an object is fully moving through time, it's not moving through space (an object at rest),

when an object is fully moving through space (an object moving at light-speed) it's not

moving through time.[36]

All of this affects our current pursuits in one relevant respect, namely the notion

of 'the present' in special relativity. The relevant issue in special relativity is often called

the relativity of simultaneity. We will examine the relativity of simultaneity more

rigorously than the previous discussion. Before we begin, however, let us say something

about Minkowski spacetime. Minkowski spacetime is a theory of space and time that is

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[36] This is meant to be a heuristic device that demonstrates the complementary nature of space and time. 'Fully' used in terms of 'fully moving through space' may be a bit confusing. Fully moving through space is meant such that when something reaches the speed of light (of course, only light can reach the speed of light) it is then 'fully' moving through space in that time effectively does not elapse for an object moving at light speed. As such, photons, which are the constituents of light, are unaffected by time because they're 'fully moving through space'.

consistent with special relativity. Here space is a four-dimensional manifold made up of spacetime 'points' with a coherent intrinsic geometry. Throughout our discussion of presentism I will use 'special relativity' and 'Minkowski spacetime' fairly interchangeably. What presentists are attempting to do is make their theory of the metaphysics of time line up with Minkowski spacetime, which in turn means their theory must line up with special relativity.

Classical Newtonian spacetime and Minkowski spacetime differ in one important respect relevant to presentism. Newtonian spacetime has a well defined notion of simultaneity (a 'present'). That is, for any point P, the set of points simultaneous with P is a 'hyperplane of simultaneity'. If any given hyperplane of simultaneity is the present at that moment, all the points temporally after that moment are the 'future' and all the points temporally before that moment are the 'past.' Minkowski and Newtonian spacetime are similar in that they both are four-dimensional manifolds of spacetime points that contain all of what happens (past present and future). In contrast to Newtonian Spacetime's notion of absolute simultaneity, Minkowski spacetime does not have a well defined notion of simultaneity. Rather each spacetime point has an 'absolute future,' 'absolute past,' and a 'spacelike separation.' The absolute future of a point P is the set of points that could be reached by signal traveling at or below the speed of light from P, the absolute past of P is the set of points that could reach P with a signal traveling at or below the speed of light and finally the set of points spacelike separated from P are those points which cannot
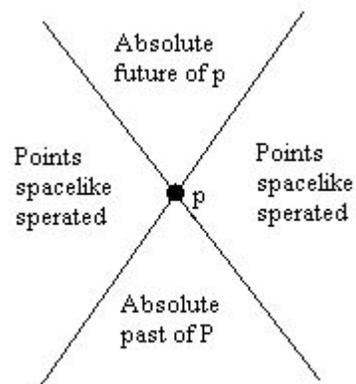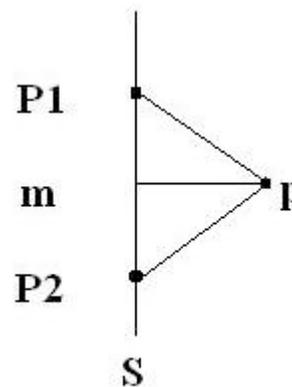
be connected to P by a signal traveling at or below the speed of light.

With these sets well-defined, one can speak of the relations between points with no need for an absolute notion of simultaneity. However, given the demands of special relativity, there is a notion of relative simultaneity within Minkowski Spacetime. A rough and ready definition of 'the relativity of simultaneity' can be found in the book *Special Realtivity, From Einstein to Strings* by Patricia and John Schwarz which states

"Two events that happen at the same time but at different locations in space according to one set of observers do not happen at the same time to any other observers moving at constant velocity relative to the first set" (pg 48, ibid).

This definition provides a good way of picturing what is happening when simultaneity is relative to an observer. We shall, however, examine the relativity of simultaneity a bit more rigorously. Consider an observer moving at a constant velocity along a path S. This will be our frame of reference. Consider a point P1 along path S; an observer emits a light signal which rebounds off another point p, and intersects S at another point P2. In Special Relativity theory, point p is simultaneous relative to the observer's state of motion along path S with a midpoint m in-between P1 and P2. Now let us imagine a different observer moving along a different path F. F is distinct from S at all points except the midpoint m on S through
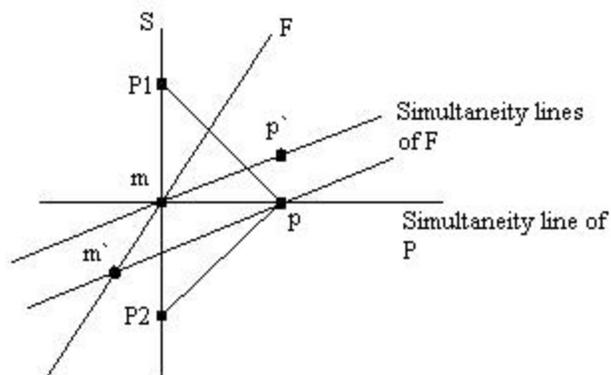
which F intersects. From the perspective of an observer traveling on F, the point p will be simultaneous with a different point, say m`, later than m. Thus relative to an observer on path S, p is simultaneous with m and relative to an observer on F, p is simultaneous with a later point m`. We can also say that, relative to F, point m is simultaneous with the point p` earlier that p. Thus simultaneity is relative to the state of motion of the observer. With this definition of simultaneity, we can incorporate notions of past and future in respect to frames of reference. Given a frame of reference R through point p, another point q is past relative to R just in case q is in the absolute past of some point simultaneous with p relative to R. Given a frame of reference R` through point p`, another point q` is future relative to R` just in case q` is in the absolute future of some point simultaneous with p` relative to R`. These are some of the basic distinctions in Special Relativity theory with respect to simultaneity.

Presentism's Conflict with Special Relativity

Following Sider, prior to the specific inconsistencies of presentism in a Minkowski setting, it is worth noting that, at the outset, presentism stands at odds with any theory of spacetime. Any theory of spacetime is founded on eternalist ideas – it consists of a four dimensional manifold of events. That is, a manifold that houses all events, past present and future. Presentism, however, consists of a single manifold that is constantly in flux. This manifold, of course, only houses the events that presently exist. Since physicists aren't worried about the metaphysical status of the past present and future, presentists can bypass this worry by simply evoking their tense operators. First they can assert a single hyperplane of simultaneity. Then, existential quantification over

non-present entities, points or events can happen within the scope of a tense operator so as to be non-ontologically committing. This makes the presentist happy. All the physicist minimally requires is that we be able to speak of past and future entities, points or events in the normal sense. Since he can technically still do this with the presentist tense operators, this makes the physicist happy. This, of course, is on the classical view of spacetime. What the presentist needs is a similar hybrid theory given Minkowski spacetime. We will thus analyze the most plausible hybrids combining Minkowski and presentist ideas that attempt to make both parties happy.

Given the lack of a 'present' in Minkowski spacetime, creating a plausible hybrid is particularly hard to do. The presentist will require that existents are confined to one hyperplane of existence, the 'present,' while the 'past' and 'future,' contain no existents. However, Minkowski spacetime contains very different notions of past present or future, and fitting these to presentist ideals will prove arduous. Of course, tense operators will need to be used in order to speak of entities, points or events, in the past or future relative to the single hyperplane of existence. While the hybrids are unanimous in the use of tense operators, they primarily differ in where exactly they place the single hyperplane of existence.

There are about five distinct hybrids of presentism and Minkowski spacetime that Sider examines. The first two I will only briefly mention because of their *prima facie* implausibility and I will focus the discussion on the remaining three hybrids. On hybrid one, all points of spacetime are non-existent except one. Besides being increasingly metaphysically exotic, (and detaching from the spirit of presentism proper) this view suffers other problems. To incorporate tense operators into the picture of Minkowski

spacetime, the presentist needs frames of reference. On this view, of course, there are no past or future frames of reference because a frame of reference requires a path extending through spacetime. There is only one point of space that is real and existent. Furthermore, the truth-maker objection becomes more strong because there is now so little being for truth to supervene upon. Finally it may be the case that no people or other macroscopic objects exist in the single existing point of spacetime. Thus, no people or macroscopic objects would exist in any straightforward sense because reality shrinks to a point.

The second attempt at a hybrid tries to work the idea of a hyperplane of simultaneity back into Minkowski spacetime. Here, the hyperplane is posited relative to some frame of reference and some point p. The view might be stated as: for some point p and some frame of reference F, the presentist asserts the reality of all and only all points simultaneous with p relative to F. One primary difference between this version of the 'hyperplane of simultaneity' view and the version on Newtonian spacetime is that the frame of reference F and point p chosen is completely arbitrary. There is no distinguished point one could consider 'the present' on Minkowski spacetime. This hybrid improves on hybrid 1, there is more being for truth to supervene on and it is possible that macroscopic objects like people exist within the hyperplane.

The main problem with this hybrid stems from its arbitrary choice of simultaneity. There is no relation of absolute simultaneity given Minkowski spacetime and this appears to be exactly what hybrid 2 is postulating. Hybrid 2 is able to say affirmatively whether or not distant events are simultaneous, something a standard Minkowskian typically cannot do. Thus, the hybrid 2 theorist essentially has to admit an absolute simultaneity relation. In this sense, hybrid 2 is scientifically revisionary in the context of Minkowski

spacetime because Minkowski spacetime only has a relation of relative simultaneity. If the presentist wants to go against the grain of Minkowski spacetime then he can assert hybrid 2, which now seems more like the Newtonian/Presentism hybrid than a Minkowski/Presentism hybrid.

Following Sider, Hybrids 3, 4 and 5 attempt to preserve the four-dimensional manifold inherent in Minkowski spacetime. The three possible ways of keeping a four-dimensional region match up with these 3 hybrids. The first way would be retaining the past light cone of a point p or the 'absolute past' of p; the second, retain the future light cone of point p or the 'absolute future' of p; and finally retain p and the areas 'spacelike separated' from p.
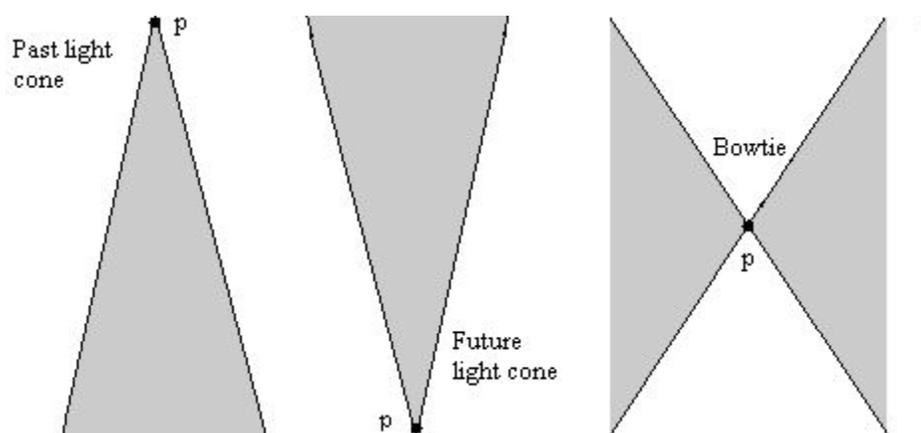
Hybrids 3, 4 and 5 dodge most of the worries hybrids 1 and 2 face. Since each of these hybrids contain a four-dimensional region, other frames of reference exist besides point p's frame which tense operators can be relativised too. There is much more being for truth to supervene upon. And finally, none of the hybrids are scientifically revisionary. Any of these regions are definable in standard Minkowski spacetime given a point p. It is the last bit that an eternalist will disagree with, namely that any point can be

distinguished in Minkowski spacetime non-arbitrarily. However, this is much like the original disagreement between presentists and eternalists.

The main problem with these hybrids is that they detach from the spirit of presentism. Hybrids 3 and 4 which postulate the existence of the absolute past or future of point p, respectively, now include just that – past and future objects. This not only detaches from the spirit of presentism, but from its central tenet, that only presently existing objects exist. The intuition that the past is no longer and the future is not yet was one that lead the presentist to create his view, on hybrids 3 and 4, that intuition no longer applies to presentism. Our other primary motivation for affirming the presentist view was its solution to the problem of temporary intrinsics. This solution no longer works on any of hybrids 3 through 5. If any object x is suitably located, then there are other points in x's past or future that are equally real as the present point. The presentist, then, would have to assert that x is F at some points of spacetime, but not others. Presentism would then be committed to relativising (in some manner) property instantiation to points of spacetime – exactly what the presentist theory of change did not want to do. Thus, if the presentist were to assert hybrids 3-5 as a defense of presentism in a relativistic setting, the presentist would lose some of the foundational motivations behind his theory.

One of the problematic themes running throughout presentism's attempts to fit into accepted physics has been its metaphysically distinguishing 'the present' from all other times. Hybrids 3-5 are no exception to this rule. Each hybrid has a certain, as Sider calls it, 'generator point' – one lucky point that gets to keep all the points in its absolute past, or absolute future or spacelike separated from it. However none of these other

existing points is granted such an exalted status. So again, the choice of which point is, in fact, the generator point seems arbitrary.

Hybrid 5 suffers a unique criticism. Presentism classically gives a metaphysical distinction to the present from the past and future. This distinction is purely *temporal*. Hybrids 3 and 4 have generator points that are distinguished temporally from other points much like traditional presentism. Ontologically privileging certain times appears much more plausible than privileging certain *places*. That is, temporal privileging seems more conceivable than spacelike privileging. The presentist, for example has good reasons for thinking the present is privileged from the past and future. It would seem odd, however, to privilege a certain region of *space* from all others in an analogous fashion. Hybrid 5 does just this. All points spacelike separated from the generator point are considered real. This sort of spacelike privileging appears implausible.

So we have reviewed 5 hybrid theories combining presentism and special relativity. The major problems with each appear to be their scientifically revisionary nature or their detachment from the original picture of presentism. Not one has seemed particularly plausible in light of these concerns. Perhaps there is another amalgam of presentism and special relativity possible that is more plausible than the five examined here. This, however, appears particularly doubtable because of the presentist's need for an absolute simultaneity relation seems to have no counterpart in Minkowski Spacetime.

We have now examined virtually all the primary theories concerning the nature of time and the nature of change. While all have their associated motivations and virtues, all also seem to suffer damaging objections. Not one clearly stands out about the rest in terms of meeting objections and accounting for our various intuitions and the physical

facts in acceptable ways. There is, however, another contemporary view exposed by Kit Fine titled 'Fragmentalism.' Every theory we've examined thus far has seemed to reject a basic assumption one can make about the nature of tense or time and because of this rejection, certain objections have be leveled against them. What Fine attempts to do with his 'Fragmentalism' is consistently assert four plausible, basic assumptions about the constitution of reality so as to avoid any of the known objections we've already examined. In the next section, we will analyze how these four assumptions demarcate the views we've already considered as well as presenting Fine's Fragmentalism.

Chapter 4: The Final Frontier? Fragmentalism & Relativism

The Four Assumptions

It is crucial to note at the outset that Fine constructs his paper around the notions of reality and tense rather than time. As demonstrated in the first section of this paper, one's theory of time is presupposed by whether or not one is either a reductionist about tense, or one 'takes tense seriously'. Further, the way in which these facts obtain (in reality), serves to also distinguish the views we've looked at. That is, tensed facts as constitutive of reality (an A-theorist) and oriented toward a certain privileged time gives us presentism, and untensed facts (a B-theorist) with no privileged times gives us eternalism (the view presupposed by four and three-dimensionalists). In demarcating views simply in terms of tensed or untensed facts and how they obtain in reality, Fine is speaking on a more general level than we have been. As such, there appear to be more possible views.

In providing a logic for the analysis of reality, Fine introduces a logical operator we symbolize as **R**. Here **R** operates on a sentence in the standard way. Consider a sentence s, if we wanted **R** to operate upon s we would write **R**(s). This would read in English, 'in reality, s' or 'it is real that s.' Thus, the sentences **R** operates upon provide statements about what is real[37]. While the simplicity of this account may appear not worth mentioning, it is important to demonstrate Fine's strong focus on *reality* as

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[37] Of course, placed within the scope of the negation operator, **R**, operating on a sentence, designates that which is not real.

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opposed to *time*. In this sense, Fine's methodology is different from ours; he approaches the problems we've been dealing with from the standpoint of how facts obtain in reality while we have been examining issues from the standpoint of time.

Keeping in mind Fine's focus on reality, Fine attempts to distinguish the various views one can hold. The first distinction Fine makes is between 'Realists' and 'Anti-Realists.' Realism asserts that tensed facts constitute reality and is neutral as to whether or not there are privileged times. Anti-realism (four and three-dimensionalists) asserts that untensed facts constitute reality and that there are no privileged times. Because Realism is neutral on whether or not there are privileged times, proponents of Realism split into 'standard realists' and 'non-standard realists.' Standard realists are the realists that orient the tensed facts towards a privileged time. Presentists would fall into this category as well as followers of Broad and Tooley who believe the past and present are privileged, but not the future[38]. Non-standard realists split into two categories which we have not yet examined in this paper, 'Relativists' and 'Fragmentalists.' Here they differ on the question of whether or not reality is absolute or relative. We will now look at these various views in terms of the four basic assumptions we spoke of earlier that concern facts and the constitution of reality.

The four assumptions about reality are laid out as follows:

Realism: Reality is composed of tensed facts.

Neutrality: No time is privileged, the facts that constitute or compose reality are not oriented towards one time or another.

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[38] We haven't said anything about this view in our discussion; however, it fits pretty easily into the 'standard realist' category. Tensed facts are constitutive of reality, and there are 'two' hyperplanes of existence, the past and present.

Absolutism: The constitution of reality is an absolute matter, i.e. not relative to a time or standpoint.

Coherence: Reality is not contradictory, i.e. it is not constituted by incompatible facts.

These assumptions are said to be the four basic plausible assumptions one can make about reality. To oversimplify the reasoning behind each assumption we might say first that the reason we use tense in such a natural way in our language is because the facts about reality appear to obtain in a tensed manner (realism). Second, while neutrality may seem to be 'pre-theoretically unmotivated' because of how we pre-theoretically distinguish tense and orient it around our present moment, the view that no time is privileged seems more plausible on reflection. For why should any time have more of a stake on what is real than any other time? There doesn't appear to be a *prima facie* reason why one time should be privileged over another. Further, neutrality is certainly the standpoint from which physicists proceed because it seems to fit better with the physical discoveries (there doesn't appear to be a use for privileging times for physical facts in physics). Thirdly, facts appear to be absolute, when a fact is constitutive of reality, it shouldn't need an associated time in order to be complete. Finally, the plausibility of Coherence should be self-evident. What is unique about them is the fact that the four taken together appear to be inconsistent. In fact, it is the inconsistency of these four assumptions that Fine believes is the import of McTaggart's argument. Before delving into their relevance with respect to McTaggart, let us first see how they break up into the views we've already examined.

We've already said a little about Realism; it is the primary presupposition of presentism, fragmentalism and relativism. The anti-realists (three and four-dimensionalists) reject this assumption. Neutrality is the driving force behind eternalism which is the primary presupposition of the anti-realists and of course the assumption rejected by the realists. Absolutism and Coherence deal directly with the level of nonstandard realism, a level we haven't examined much yet. Presentists, four-dimensionalists and Fragmentalists accept Absolutism while the view we are calling 'relativism' rejects absolutism. Coherence is an assumption that all theories of time, reality and tense attempt to uphold (and as we saw, the primary assumption driving four-dimensionalists to assert temporal parts as the primary bearers of properties and three-dimensionalists to assert properties as relations to times). As we will see later it is not obvious whether or not Fragmentalism is accepting or rejecting Coherence. It appears that the Fragmentalists are rejecting a more specific form of Coherence, namely, Closure which states that if p is real and q is real then the conjunction, p & q is real. We will examine this issue later.

The Indistinguishability of Non-Standard Relativism and Mellorian Relativism

Relativist Theses

Relativism is the view that all facts constitutive of reality are given relative to a time. Thus reality is not an absolute matter. This construal eliminates conflict with Coherence; contradictory facts are not asserted, however, it diverges from our intuition

that facts can be facts *simpliciter* (the absolutist assumption). Facts on this view must be given in terms of relations to times. Here I will digress a bit to consider an interesting question concerning this view: does the relativism with respect to change that most three-dimensionalists assert, as reviewed in the section on change, fall under the category of this more general relativism? To begin answering this question, it is first worth noting that three-dimensionalism plus relativist change falls under the anti-realist category. That is, the general category of relativism we're explicating here (non-standard relativism) accepts Realism, while relativist change theorists reject Realism. That is, the relativist change theorist reduces tensed statements to relations of earlier than and later than while the non-standard relativist takes tense seriously. What we are interested in here is whether or not relativist change theorists assert that *all* facts constitutive of reality are relative or whether just the special set of 'facts concerning change' or 'incompatible facts' are relative. Where the relativist change theorist says that facts about change, i.e. the candle being bent, the candle being straight, are to be given relative to times, he could also say that essential or 'kind' facts like x's being a candle need not be given relative to a time. The more general relativist, however, would assert that even these facts need to be given relative to times (as unmotivated as this may seem). We will see that this is one of five ways the two views might be distinguished. However, we will argue that in terms of the relativist theses of either view, the two views appear indistinguishable.

The primary relativism-with-respect-to-change thesis comes from D.H. Mellor's *Real Time*. Reading through the core thesis and its implications, nowhere does he seem to speak of a 'general relativism,' or 'the relativism of all facts,' but rather only talks about properties being relative to times when they are properties 'involved in a change'. It is

worth noting here that Mellor restricts his subject matter to *things* changing[39]. By *things* Mellor means any entity that lacks temporal parts (i.e. objects that are wholly present at every moment of existence). We typically think of *things* in Mellor's sense as objects, entities etc. We've already examined in detail the various ways one might account for things changing. Mellor's explanation of how things changes matches up with Fine's non-standard or general relativist fairly seamlessly. That is, for Mellor, any intrinsic property a thing instantiates is to be given relative to a time; for Fine's relativist, any fact constitutive of reality is to be given relative to a time. Given this, it seems natural to then examine if and how *events* change, and if Mellor's account and the non-standard account can be distinguished in this facet of metaphysics. Keeping these two accounts consistent and having them fit nicely into one's theory of time at large will be important. Let us begin by saying some things about events.

Changes in Events

First, what are some examples of events? Wars, football games, presidential debates, thesis meetings, dinners, operas, certain actions like 'standing up' etc, all of these examples we intuitively call 'events'. One common feature we might notice about them is that they all occur over a time interval. In fact, it seems to be a necessary condition of 'being an event' that whatever it is we're calling an event occurs over a time interval. This is to be distinguished from our intuitive view of objects or entities which

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[39] While not necessary for our discussion, Mellor also distinguishes *genuine* cases of change. By *genuine* change he means (to speak loosely) change of the 'primary' properties of an object like shape size temperature etc as opposed to 'secondary' changes involving relational properties, changes in Goodman-predicates etc. By Goodman-predicates we refer to predicates analogous to 'grue' and 'bleen' first introduced by Nelson Goodman in his discussion of the problem of induction. For Mellor's discussion of these, refer to page 108 in his 'Real Time.'

may *exist* over a time interval, but certainly don't *occur* over a time interval. Objects rather, intuitively, are wholly present at every moment of their existence. As an aside, four-dimensionalists believe they have good reasons for thinking that objects do, in fact, 'occur' over an interval like events, but we will set this view to one side for the purposes of this discussion. Another interesting feature about events is that they seem merely to be a collection of things changing over a time interval. That is, every one of the 'event-designations' used above in our examples could be reduced to a long string of things changing throughout the time interval that the event lasted. Take, for example, the football game. To say 'I went to the football game' would be reduced to 'I went to the place p during the interval of time T in which, during T, Fa at t_1, Fb at t_1, Cm at t_5 etc etc'[40]. This serves to demonstrate how events just are a collection of things changing over an interval of time. However, one must note that ridding ourselves of event-designations would then mean every time we spoke of a putative event we would in fact mean an exceedingly long and complex statement about a collection of things changing over an interval of time. Because such a meaning is implausible given its complexity and using event designations is much simpler, it appears that we have good reason to not reduce events in this manner. Thus, in principle it may be possible to reduce events in this way, but in practice virtually impossible.

Given these features of events, it is clear that events are distinct from objects. Objects are wholly present, events are extended through time. Events are collections of things changing over an interval of time[41] while objects are things which instantiate

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[40] This of course assumes the relativist response to the puzzle about change. It is easy to see how other responses to the puzzle about change could replace the response being used.
[41] Let us be clear here that I am not advocating the reduction. In the same way that a realist is animated by a robust conception of tense (even though a tenseless reduction is possible) I am animated by a robust

certain properties and stand in certain relations to other objects. Further objects can change their properties, and, at least *prima facie* events themselves do not change their properties because they don't insatiate certain properties in the same way that an object does. Rather, in a slogan, events are changes. Because they just are a collection of changes occurring over an interval, they themselves do not have changing properties like an object does.

While this fact may seem intuitive at first, on reflection it appears rather that events, in fact, *do* have changing properties much like objects. Arthur Prior writes on this very subject in his 'Changes in Events and Changes in Things'. He provides numerous examples of this, most notably that of an acceleration where something is said to accelerate at some amount of feet per second per second. Similarly we might think of the '2nd derivative' of a position function as a representation of an event changing. The first derivative represents how the position of some object is changing while the 2nd derivative represents how the event, 'object's changing position' is changing. Consider a more intuitive example. We decide to have a party in the back of a moving semi-truck that occurs over the interval T. We will call the event here, the party, 'e'. Event e, which is a collection things changing (people talking, drinking, moving etc) itself changes during the interval T. Let's stipulate that the semi-truck moves from location a to location b during T. Accordingly, e, changes from location a to location b during T. We could also imagine that e gets larger and smaller, as well as louder and quieter during T. That is, the

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conception of events. The realist is motivated by how fundamental tensed language is in our everyday communication. Analogously, I am motivated by how fundamental event-designations are in our language. Thus, in saying that events just are a collection of things changing over an interval of time, I am not saying that events are no longer constitutive of reality, but rather while events *could* be reduced, they should not be.

event e, which is a collection of things changing, itself changes over the interval T.

Given this, events then *do* change in a manner analogous to how things change.

In light of this discussion, it would seem that the puzzle of change, examined earlier, which deals with change in things, should apply in some analogous manner to change in events. That is, we need to account for change in events in the same way that we account for change in things. Given this, it appears that since events are analogous to objects on the four-dimensionalist view (regardless of one's view about objects), the four-dimensionalist solution to the puzzle of change with respect to things should be the correct solution for the puzzle of change with respect to events. To briefly substantiate this claim, note again that events occur over an interval of time, just like objects do on the four-dimensionalist view. Since they occur over an interval of time, they have temporal parts like a first half and a second half. These temporal parts can be appealed to in dealing with the puzzle of change with respect to events (as the perdurantist does with respect to things). Not surprisingly, our paradigmatic example of a three-dimensionalist and relativist change theorist, D.H. Mellor[42], does exactly this. He asserts that while things do not have temporal parts and their properties are to be given as relations to times, events do have temporal parts and, presumably, their properties are to be instantiated by the various temporal parts of the event. While this is what one would expect, Mellor, in fact, believes that events *do not* change in an analogous manner to things. He brings this out as follows:

> "I said in chapter 1 that things are not events. The difference is that things have no temporal parts, even when their dates span extended intervals of B series time. In other words, things are wholly present throughout their lifetimes and events are

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[42] In the rest of this discussion I will use 'Mellor' and 'relativist change theorist' interchangeably.

not. This is why things can change *and events cannot*.**[43]** Apparent changes in events are no more than differences between their temporal parts, analogous exactly to differences between spatial parts of things." (*Real Time*, 1981, pg. 104)

So was Mellor not swayed by Prior? Or did he simply just not recognize that events can change in a similar manner to things? The former seems correct, for, according to Mellor, if there are changes in events, they are merely appearances that can be explained by differing temporal parts. Considering this along with our examples, when the party, e, in the back of the semi-truck changes from quiet to loud or from location a to location b, e's temporal parts instantiate these different properties, but, according to Mellor, such a putative change is not a case of change. Why would Mellor think this? Such a change appears virtually synonymous with genuine cases of change in things. Furthermore, if he admits these as genuine cases of change in events, he can easily account for them using the temporal parts that events intuitively seem to have.

The only reason he has not to admit that events can change, is that in admitting such a fact he is allowing an entity with temporal parts to be capable of (genuine) change which might further ground the perdurantist view. Furthermore, if he is going to admit that events can (genuinely) change, than for uniformity of his view, he *should* assert that these changes need to be accounted for in the same manner as changes in things, namely, as relative to times, not parts. This would then create an added level of complexity with respect to events: events change like things change; this change could be accounted for by appeal to their temporal parts, but in fact it must be accounted for by relativising the changing properties to times. So now events have temporal parts, and yet their properties are to be given as relations to times, instead of just properties that the various temporal

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[43] My italics.

parts have *simpliciter*. Again, Mellor is not committed to this view, but it certainly appears that he should assert it if Prior is right. To restate: things change, this is explained by relativisng property instantiation to times. If Prior is correct, events change analogously to things, this could be explained by temporal parthood, but for Mellor's view to remain uniform, it should be explained by relativising property instantiation to times. I believe Mellor is committed (in a weak sense of the term) to the latter view.

If Mellor is, in fact, committed to this view, it then seems that his view cannot be distinguished from Fine's non-standard relativist on this count. For the latter relativist's foundational thesis is that facts constitutive of reality are relative. Thus any facts concerning the properties things instantiate or the properties events instantiate will be relative. Accordingly, this more complex version of Mellor is equivalent with the non-standard relativist on this account. Since Mellor seems to be committed to this more complex view in a weak sense, then the relativist change theorist cannot be distinguished from the non-standard relativist with respect to change in events. Since it now appears that a relativist change theorist and a non-standard realist relativist would have to agree on how to account for changes in events, we might wonder if our earlier claim about them being indistinguishable in the case of change in things might be false; perhaps there is some special sense in which they can be distinguished.

Compatible and Incompatible Facts

While being mindful of the special sense of 'things' and their intrinsic properties, one way the relativist change theorist might attempt to distinguish his view when posed with this non-standard relativism is via incompatible facts. Consider the set of all the

facts about an object throughout its lifetime. Now take the subset of that set which contains any fact that is compatible with every other fact in the set. Assume that compatible-fact$_1$ (from the compatibility subset) corresponds to the statement 'x is F' and compatibale-fact$_2$ corresponds to the statement 'x is P'. Since these facts are from the compatibility subset, asserting compatible-fact$_1$ and compatible-fact$_2$ simultaneously (and any other combination of compatible facts from the compatibility subset) will not result in a contradiction. Accordingly, the facts within the compatibility subset need not be indexed to times. The facts that do not make it into the compatibility subset, however, will need to be indexed to times to account for their incompatibility. If Mellor were to assert this, his view would then be distinguished from non-standard relativism because the non-standard relativist is committed to asserting that even the facts within the compatibility subset must be indexed to times.

While this dodge absolves Mellor's view from being a non-standard relativist, it also seems to lack sufficiently good reasons for carving up reality in this way. It is certainly more intuitive that all facts are facts *simpliciter* (given absolutism). Just because a set of facts are incompatible they should then suddenly be given as relative to times, as Mellor would posit, seems to be a bit arbitrary. It appears that either all facts should be facts *simpliciter* or all facts should be given relative to times. To distinguish a set of facts as relative, namely the set of incompatible facts, while motivated (via handling the contradiction) seems arbitrary: Why shouldn't another set of facts be relative? Why shouldn't all facts be relative? Why is it that just this special set is relative? Responding here by way of appealing to their incompatibility almost seems ad hoc. Thus, it makes more sense for the relativist change theorist to assert that all facts about things are

relative because, first, he has no reason not to do so and, second, in specifying a definite set of facts as the only relative set, he seems to be doing something either arbitrary or ad hoc. Accordingly, the non-standard relativist cannot be distinguished from the relativist change theorist on this count either.

Kind Properties

The third way the two forms of relativism may be distinguished is one which we brought up while introducing this topic. That is, the relativist change theorist might say that the relative properties are those properties an object has that can change, for example, color shape mass weight temperature etc. However the properties an object has which, perhaps, cannot change, an object's essential or 'kind' properties need not be given relative to times. For example, the candle, x, has the property of 'being a candle'. If x is to remain one and the same thing, this property cannot change in the way we typically think properties of a thing change. This claim, of course, raises interesting and highly controversial questions about composition. One might say that actually x can change to being a wax puddle (when the candle melts) and still be one and the same thing. Here, of course, since x's kind property is changing, it would need to be given relative to times. Another might say that when the candle x melts down to a wax puddle the candle x goes out of existence and a new object (the wax puddle) comes into existence. Then, the fact that 'x is a candle' is a fact that never changes and thus need not be given relative to a time. Accordingly, Mellor might claim that x's being a candle is eternal and unchanging in this sense, and is a fact *simpliciter*. Since the non-standard relativist would need to say that it is still a relative fact, the two views are then different.

The problem with this attempt is rather obvious. It is clear that there may, in fact, be times when x does not exist. Presumably, at the times when x no longer exists, x is no longer a candle. Thus, x will no longer have the property of being a candle. Accordingly, since being a candle and not being a candle are incompatible, these properties would need to be given relative to times. One might respond to this by asserting that there is such a property, F, that objects have had timelessly and is unchanging. That is, there exists a property 'F' such that for all times and for all x either Fx or ~Fx. However, where the property F is imagined to be, to speak loosely, an 'everyday,' 'run-of-the-mill' kind property, the existence of such a property at every time t seems far too exotic to be plausible. Admitting that there have always been and always will be objects with a property like F (imagined this way) raises questions about whether time has end points, whether there have always been objects in time etc. It seems to add a lot of unnecessary complication on top of being hard to imagine. It certainly seems far more intuitive to say that for any object and any kind property, if there exists some time that it has that kind property, then there exists some time that it does not have that kind property.

There is, however, one putative property that fits the criterion for being F, viz. the property of being self-identical. Self-identity certainly appears to be a property that objects have had and will always have and never changes. As such, it is not clear whether or not it should be relative on these views. Perhaps, because reality is relative for the non-standard relativist, he must say 'x is self-identical at t,' and Mellor need only say 'x is self-identical' because self-identity fits the earlier criterion. The property of being self-identical, though, is exotic and apart from 'everyday,' 'run-of-the-mill' kind properties. My contention on this issue goes two ways. Either the two views should not be

distinguished on this one single count (even if they account for self-identity differently) because self-identity is in a class of exotic properties, or that if the non-standard relativist submits that 'x is self-identical' need not be given relative to a time, his thesis that facts constitutive of reality are relative remains untouched (he remains a non-standard relativist). For I do not believe admitting an exotic property like self-identity topples his view. Thus, I believe the Mellor view cannot be distinguished from non-standard relativism on this count either.

Tense

The fourth way the theories might be distinguished is given by Fine. Here he appeals to the fact that the relativist change theorist is typically an anti-realist while the general relativist is typically a realist. Because of these separate presuppositions, the two forms of relativism are different. For the anti-realist relativist, facts at a time are a *facet* of reality and "what properly belongs to reality is not the facet itself, but the fact that it is instantiated at the given time." ('Tense and Reality in *Modality and Tense*, 2005, pg. 279). For our non-standard relativist or relativist that accepts realism, facts at a time are an *alternative* reality, it is "… another reality on an equal footing with the current reality; and the facts belonging to such a reality are full fledged facts," which do not share in the "incomplete status of a facet." (pg. 279, ibid) While the rhetoric here seems to suggest a genuine distinction, upon reflection, the distinction appears to be superficial. For the non-standard realist relativist, and the anti-realist relativist only truly differ on one count, namely, that tensed facts are constitutive of reality. The status of tensed facts, at least at face value, do not seem to play any role in modifying the relativist content of either view

such that they can be distinguished on this count. For both relativists accept neutrality, which means that for both relativists any fact, regardless of the time instantiated, is on equal footing with any other fact. Perhaps what Fine is attempting to point out is that the realist relativist can talk about the *current* reality because he takes tense seriously while the anti-realist relativist can only talk about reality at t. While this is certainly true, I fail to see how this by itself distinguishes anti-realist relativism from non-standard realist relativism in terms of the relativist aspect of either theory.

Logical Syntax and non-instantaneous change

The fifth way the views could potentially be distinguished, I submit, succeeds in distinguishing them, however, in a special way. This method for distinguishing the relativist theories focuses on the logical grammar either theory would employ to connect language with reality. Luckily, the opposing grammars were presented in an earlier section, namely the section on instantaneous change. Here we examined a syntactical structure I referred to as the 'operator view,' At t: Fx, and another I referred to as the 'relationist view,' F(x, t). I attributed the former view to Prior and the latter to Mellor. Note here that Mellor proposes the relationist grammar in his *Real Time*; he fits that form of grammar to his relativist theory of change. The argument will go that the operator syntax is more suitable for the non-standard relativist than the relationist syntax. Since Mellor and the non-standard relativist employ distinct forms of logical grammar to connect language to reality, they can be distinguished.

First, why do they employ these different forms of grammar? Mellor is primarily concerned with statements of the form 'x is F' since these are the statements that

primarily occur when one is talking about a changing object. Since his thesis ultimately is that the analysis of 'x is F' is that F is really a relation between x and t ('x is F at t') it seems natural that he would then prefer the relationist view F(x, t). The non-standard relativist however is asserting the universal claim that all facts constitutive of reality are relative. Thus, the importance of 'At t:' operating on every statement of fact seems obvious. 'At t: φ' just appears to be the natural way of analyzing the claim that facts constitutive of reality are relative to times.

Now let us recall the claims I made about these two forms of syntax in the instantaneous change section. There I claimed that anyone holding the relationist grammar is committed to all changes occurring instantaneously. This is because there was no way for a relationist to be consistent with the law of excluded middle and postulate a '3rd state' in which an object could be said to be 'changing'. The operator syntax, however, allowed for consistency with the law of excluded middle and a third state because '~At t: Fx' was distinct from 'At: ~Fx'.

Now, setting aside the notion of a third state or non-instantaneous change, I assert that '~At t: Fx' and 'At: ~Fx' are not distinct, and both translate into ~F(x, t) on the relationist grammar. Furthermore (again setting aside the notion of non-instantaneous change), I assert that for any well formed formula on either grammar, there exists a translation procedure from operator syntax into relationist syntax and from relationist syntax into operator syntax that preserves well-formedness and truth value[44]. Thus, if we

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[44] Paul Hovda and I have worked on the details of this translation. While we did not reach a final statement of the details, there is good reason to think a translation can be given, except for one potential difficulty. The translation from relationist syntax into operator syntax is so intuitive it verges on being trivial. The translation from operator syntax into relationist syntax requires some work. Most importantly there is an issue with the range of quantifiers in certain putative well formed formulas of the operator syntax and just how these restricted quantifiers would translate into the relationist syntax. Take, for example, the formula,

set non-instantaneous change to one side, Mellor and the non-standard relativist cannot

be distinguished in terms of the logical syntax they use to connect language to reality for

the two forms of logical syntax are inter-translatable[45]. However, if the non-standard

relativist accepts non-instantaneous change and thus distinguishes '~At t: φ' and 'At t: ~

φ' and Mellor does not accept non-instantaneous change to stay consistent with the law

of excluded middle, then there is no translation procedure for '~At t: φ' and 'At t: ~ φ'

into relationist grammar. Thus here is the *only* place where the two relativist theories

could be distinguished. Note further, that if the non-standard relativist accepted non-

instantaneous change and Mellor also accepted non-instantaneous change and

consequently gave up the law of excluded middle (or reverted to a three valued logic) I

believe that a translation procedure would most likely be possible although one has not

been worked out in detail.

Given these five ways in which we might distinguish the relativist change theorist

from the more general relativist or non-standard realist relativist, none of them appear to

do the job except if the non-standard relativist accepts non-instantaneous change and

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'At t_1: $\exists x \exists t_2$, At t_2: $\neg \exists y \; y=x$,' or, in English, 'at time t_1: there exists an x, there exists a time, t_2 such that at t_2: it is not the case that there exists a y such that y is identical to x. Consider an instance of this formula. Suppose that t_2 refers to 6:18pm on Nov. 28th 2007 and t_1 refers to same time/month/day in the year 430 B.C. Then we might say that there existed an x, Socrates, at time t_1 and there does not exist a y at time t_2 such that y is identical to Socrates. We're basically saying that at t_1 Socrates exists and at t_2 Socrates does not exist. On the relationist syntax, it appears that quantifiers cannot be restricted in a similar manner. Thus one might think that the translation procedure is then impossible. I would argue, however, that because both the views accept Neutrality, one cannot consistently assert that Socrates does not exist. That is, in accepting Neutrality, one is committed to the fact that in an interval of time earlier than now, Socrates exists. Since no time is privileged, Socrates exists. Thus, the non-standard relativist could not assert the formula used above because the quantifiers cannot be restricted in the appropriate sense. The quantifiers must range over all times and all objects found at those times because no time can be privileged in the sense of the presentists privileging of a time (upon the acceptance of Neutrality). Thus, I conclude that the translation procedure remains plausible because this problematic formula is logically false on the non-standard relativist view.

[45] It would also be interesting to see if the Quinean view, where the relation between x and a time is a relation between a temporal part of x, and a 3 dimensional cross-section of the universe, is also translatable into operator/relationist syntax. Given that the relative aspect of Quine's view has an analogous structure to these other two, my hunch is that it might be.

Mellor does not. Since I believe most will find the argument for non-instantaneous change contentious, I believe the relativist content of either view are essentially equivalent. In fact the only area in which they truly differ is there take on the status of tensed facts. Since one's take on the status of tensed facts does not appear to modify one's relativist assertions, we have two almost equivalent views on two distinctive sides of the tense and reality issue. We will now move away from this digression and back to Fine's four assumptions and how they relate to McTaggart's argument.
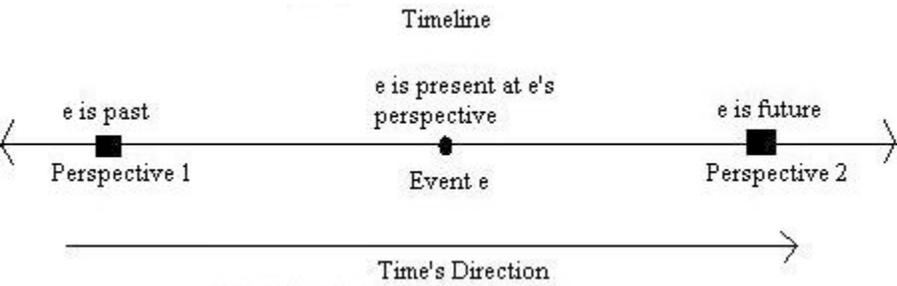
Fragmentalism

The Import of McTaggart

Following Fine, the import of McTaggart's argument is simply this, given these four basic assumptions about the constitution of reality, we cannot consistently assert all four and consequently, we are forced to accept a view of time based on which assumption(s) we reject. By Realism, reality will be constituted by tensed facts and by neutrality different tensed facts that obtain at different times have an equal claim on reality. Given any interesting account of reality, there will be incompatible facts. By Coherence reality is not contradictory, so either we must rule out incompatible facts or deny neutrality. By absolutism, we cannot account for the incompatibility by having facts obtain relative to times.

We might 'picture' the issue as follows. Consider an event e; e has exactly one status, past present or future given a certain perspective, P_1, in time. This follows from realism. Consider a distinct perspective in time, P_2; from P_2, event e has exactly one

status, past, present or future. Consider another perspective, P_3; from P_3, event e has exactly one status, past present or future. By neutrality, P_1, P_2, and P_3 all have equal footing in reality. There certainly are combinations of P_1, P_2, P_3, … P_n which all agree on which status event e has. However the majority of combinations of P_1, P_2, P_3, … P_n will contain different perspectives which disagree on which status event e has. For example, from P_1, e is present, from P_2 e is future, and from P_3, e is past. Keeping Neutrality in mind, e then is past present and future. This, however, is to violate Coherence, because e can only have one of these properties at a time.

Timeline

e is present at e's
perspective

e is past

e is future

Perspective 1

Event e

Perspective 2

Time's Direction

With the fundamental issue exposed, one seems compelled to proceed by rejecting one of the basic assumptions. However, in rejecting intuitive assumptions, objections are easily leveled against one. As such, we should try and construct a theory that either consistently asserts all four assumptions, or asserts something close to them. This appears to be the task of the Fragmentalist.

Fragmentalism

Fragmentalism for Fine asserts that reality is composed of tensed facts, that no time is privileged, and that facts are not relative. How Fragmentalists deal with Coherence is, however, not at all clear. Fine does appear to categorically assert that Fragmentalism is a denial of Coherence, that reality is 'irredeemably incoherent'.

However, one of the central tenets of Fragmentalism is that while P and not-P can be part of reality, the conjunction of P and not-P cannot. Thus it isn't necessarily Coherence the Fragmentalist is particularly concerned with, but rather Closure which states that **R**(p) & **R**(q) → **R**(p & q). Closure does seem to bear a close relation to Coherence. Perhaps if Coherence was construed as the claim **R**(p) → not-**R**(not-p) then Fragmentalists would be decisively denying Coherence. In some sense, then, Fragmentalists are denying Coherence, p and not-p can both be constitutive of reality. However, they are not asserting that reality is utterly contradictory because the conjunction of P & not-P can never obtain, so in another sense they are asserting all four assumptions when Coherence is modified to look more like Closure. Coherence would have to assert not that P and not-P cannot obtain, but rather the conjunction (P & not-P) cannot obtain.

To assert a view of this sort, reality must be fragmentary. Reality will be divided up into various fragments, each which contain all the true facts at that fragment. Every fragment has an equal claim on what is real, so P can be constitutive of reality in one fragment and not-P in another. However there is no fragment in which the conjunction of P and not-P is constitutive of reality. Fine brings this out nicely in the following quote, "[the Fragmentalist] position should not be seen as an invitation to accept contradictions. Even if reality contains both the fact that I am sitting and the fact that I am standing, it will not be correct for me simultaneously to assert both that I am sitting and that I am standing" (pg. 282, ibid). So in some sense the Fragmentalist is denying Coherence, but what he is definitely denying is that incompatible facts can be conjoined simultaneously. A distinction one might make (and, in fact, Fine makes this very distinction) is between the fragmented reality and the 'meta-reality'. On the level of the fragmented reality,

reality is not incoherent, no incompatible facts are asserted at any one fragment. On the level of meta-reality, where all the facts are taken as a whole, (every set of facts from every fragment at every time) reality is incoherent.

Given this, it is fairly clear how the Fragmentalist might deal with the puzzle of change. Recall that this puzzle deals with the problem of temporary intrinsics and the goal of any theory is to meet four intuitions about change. These intuitions were, 1.) That the object persists through the change, 2.) That properties are in fact properties, not relations, 3.) That the object itself has the properties, and 4.) That the different properties involved in the change are incompatible. Fragmentalism meets 1, one and the same candle persists through the change (presumably objects are three-dimensional on the Fragmentalist view). Fragmentalism does not relativise properties to times to avoid contradiction, like bent and straight, so it meets 2. Objects do not have temporal parts on the Fragmentalist view, so the candle itself has the properties bent and straight which means it meets 3. And bent and straight are incompatible properties on the Fragmentalist view, so it meets 4.

Fragmentalism has interesting consequences in terms of how language connects with reality. Intuitively, we believe that an utterance is true just in case what it states is verified by the facts[46] (the facts here referring to the facts about reality). The Fragmentalist, however, has a unique view of reality; every fact that obtains in a fragment is equally constitutive of reality, but given different fragments, different facts will be constitutive of reality 'at their particular fragments'. Thus, when an utterance is made, a

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[46] This intuitive view raises issues for the standard realist with respect to the truth of tensed statements. Fine discusses the issue in depth beginning on page 288.

certain fragment will be picked out, and its associated sets of facts will verify the truth value of the utterance. Because of this, the Fragmentalist modifies our natural intuition; viz. an utterance is true just in case what it states is verified by the facts that obtain at the time of utterance. Accordingly, the time of utterance will be necessary in determining which set of facts from which fragment we wish our utterance to be appraised from. This departs significantly from the natural view which asserts that an utterance determines a proposition and reality decides whether or not the proposition is true. Now the utterance determines both a proposition and the fragment of reality by which the proposition is to be evaluated. The utterance is then true just in case the proposition is verified by the facts at this particular fragment.

To make clear the function of utterances in the framework of Fragmentalism, Fine introduces a distinction between the *target* of the utterance and the *topic* of the utterance. Here we are speaking of a tensed utterance made at a time t which, naturally, we presume will be about a world w and the time at which it is made, t. This utterance will then be reduced to the necessary, tenseless proposition of the anti-realist. Such propositions are said to be about the time t and the world w as a topic. Since a Fragmentalist is also a realist, this analysis will not do. On Fine's view, a tensed proposition at a time t is about a world w and that time t as a target. That is, "it is about the given time or world in the sense that it is facts that constitute how things are at the time or in the world that are relevant to determining whether the utterance is true" (pg. 296, ibid). This serves to make more explicit the idea of the utterance determining which reality the proposition it expresses is to be evaluated at (which is the function of the target). The proposition expressed by an utterance will determine which tensed facts make it true while the target

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will indicate which set of facts from a given fragment to evaluate the proposition at. This gives us a certain understanding of just how language will connect to the Fragmentalist's unique metaphysics.

Fragmentalism in the Context of Special Relativity

As we saw previously, Special Relativity poses an acute threat to theories that posit privileged times like presentism. Since Fragmentalism bears a similarity to presentism in that Fragmentalists take tense seriously, Fine is concerned specifically with Special Relativity's compatibility with tense-theoretic realism (taking tense seriously) and more generally with its compatibility with Fragmentalism. Fine makes the similarity between presentism and tense-theoretic realism very clear: our standard form of presentism in which there is a privileged time he calls 'ontic presentism'. This is a theory about what things exist. Here existence is restricted to a single hyperplane, as we saw previously. The tense-theoretic realist, who holds that tenses are constitutive of reality, must orient those tenses toward the present and thus he calls this view 'factive presentism'.[47] This is a theory about how things are. It is easier to see now, in light of the previous discussion, the difficulty in making compatible tense-theoretic realism and Special Relativity. For orienting facts toward a particular time will prove arduous in the framework of Special Relativity.

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[47] To ensure a lack of confusion, in orienting the tenses toward 'the present' the tense-theoretic realist need not hold that the present is privileged, it is just that orienting the tenses in any other way would serve to make realism lose its appeal. Note further that Fine discusses at length the similarities and differences between factive and ontic presentism. I believe this short presentation will serve for our purposes, but if one would like to consult Fine's discussion, it begins on page 299 of Fine's 'Tense and Reality'.

As we saw previously, the primary problems with combining presentism and Special Relativity involved either having to posit an absolute notion of simultaneity, or the arbitrariness of picking one frame of reference as the real frame. Fine avoids this by simply asserting that *all* frames are equally real and on the Fragmentalist view, that, in fact, the fragments break up according to frames. That is, each frame of reference contains a different fragment of reality which has a set of true facts about the constitution of reality at that fragment and which are as equally real as the facts at any other fragment. To avoid confusion, let me explain the use of 'contains'. Fragments are not in a one-to-one correspondence with frames. Frames, rather, contain a collection of fragments. Every moment there is a new fragment which houses all the true facts in that fragment at that frame. Since frames need not be momentary like fragments, frames will contain a set of fragments. Accordingly there is no single frame that is real (they all are) nor is there an absolute notion of simultaneity (rather, simultaneity is given in the traditional way, as relative to frames of reference). So how is Fine able to incorporate tense-theoretic realism into this view?

With no notion of absolute simultaneity to be found in Fine's hybrid of Special Relativity and Fragmentalism, how exactly are we going to orient tensed facts? The answer to this question: having different simultaneities at different fragments within the frames. That is, every frame of reference will have a plane of simultaneity in that frame at any given time. We could consider a plane of simultaneity in a frame as 'the present within that frame'. From this, we could then orient tensed facts within a frame around a plane of simultaneity. This plane of simultaneity or 'present' will be changing from moment to moment as well as being supervenient on the motion of the frame (note that

the fragments within the frame will be changing from moment to moment as well). The tensed facts that are oriented around this changing plane of simultaneity will change along with it (much like they do in our intuitive notion of the changing present). So, just as fragments of reality are broken up relative to frames, tensed facts within each fragment are oriented around a plane of simultaneity within that frame. There are no tensed facts outside of a frame of reference. In this sense, there are no 'ultimate facts' about reality (that is, apart from fragments) other than the fact that reality itself is fragmentary. Fine, now, appears to have upheld our basic intuitions about the constitution of reality, namely that there are tensed facts, that no time is privileged, that facts are not relative and that reality is not contradictory[48]. And he has been able to incorporate these intuitions into the unique, accepted physics of our current era.

Conclusion

Fine's work has been a nice way of concluding our discussion in its entirety. This is because his clear representation of the four basic assumptions and their McTaggartarian import has shown us how the various views we've already presented in high detail break up. The four-dimensionalist denies tensed facts, and thus suffers from the fact that tensed propositions are so intuitive to us and fundamental to our everyday communication. He also posits space-time worms composed of temporal parts that are to be identified with objects which he uses to account for the contradiction in incompatible properties an object might have. This is another aspect of his theory that seems metaphysically exotic and unintuitive to us; objects seem to be wholly present. The three-

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[48] This, of course, has to be qualified. On the 'meta-reality' level reality is contradictory in the sense that P and not-P can obtain while the conjunction (P & not-P) can never obtain. On the fragmented-reality level, reality is not contradictory.

dimensionalist wants to save us from this exotic idea in positing that objects are wholly

present, but in doing so they have to account for the contradiction in incompatible

properties by making properties relations, which rejects absolutism. This is aversive to us

because properties certainly seem to be properties. Further, the three-dimensionalist also

denies realism and so suffers in the same way the four-dimensionalist does. The

presentist agrees with our intuition towards tensed facts, but to make sense of them

denies neutrality. This is disagreeable because there seems to be no reason why one time

should be privileged over another, and furthermore, causes significant problems with the

accepted physics of our day. Thus, we're left with Fragmentalism which seems to deny

the only remaining assumption, Coherence, but is denying it in a special way. Here

Fragmentalism agrees with our intuition about tense, agrees with our intuition about

unprivileged times, agrees with our intuition about facts being facts *simpliciter* and

agrees with our intuition that reality is not contradictory, at least on the fragmented level.

Furthermore, Fragmentalism accounts for our intuitions about change, gives a linguistic

analysis to match its metaphysics and fits with our contemporary physics nicely. Thus,

Fragmentalism appears to stand above all others in its field of study.

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