THE A-THEORY: A THEORY

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ABSTRACT OF THE DISSERTATION

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A-theories of time postulate a fundamental distinction between the present and other times. This distinction manifests in what A-theorists take to exist, their accounts of property change, and their views about the appropriate temporal logic. In this dissertation, I argue for a particular formulation of the A-theory that dispenses with change in existence and makes tense operators an optional formal tool for expressing the key theses. I call my view the minimal A-theory. The first chapter introduces the debate. The second chapter offers an extended, logic-based argument against more traditional A-theories. The third and fourth chapters develop my alternative proposal. The final chapter considers a problem for A-theorists who think the contents of our attitudes reflect changes in the world.
I’ve loved working on this project over the past few years, largely because of the exciting philosophers I’ve been fortunate to work alongside. Tim Williamson first introduced me to tense logic while I was at Oxford. He helped me through some confused early stages, and his work on modality inspires the minimal A-theory. When I moved to New Jersey in 2007, I joined an extraordinarily warm and creative community. I owe much to my committee members—Andy Egan, Jeff King and Ted Sider—for their indispensable suggestions on drafts. Andy especially helped me debug Chapters 3 and 5 and motivated me to finish with threats of snake fights. Outside of the committee, Heather Demarest, Tom Donaldson, Ben Levinstein, Karen Lewis, Barry Loewer, Jason Turner and Jenn Wang asked especially thought-provoking questions, challenged me to be more clear, and served as patient sounding-boards. Audiences at Rutgers and Notre Dame provided useful feedback in the late stages.

Still without doubt my greatest debt is to Dean Zimmerman, the Ph.D. director sine qua non. Throughout the process, Dean has been overwhelmingly generous with his time, providing detailed comments on over 1000 pages of material. He was relentlessly encouraging in our meetings, and I always left excited to turn the next corner. Dean’s also been an outstanding teaching and professional mentor... not to mention a source of many excellent music recommendations. (At least two thesis meetings began or ended at the Princeton Record Exchange.) If it weren’t for Dean, I doubt I would have written so much on time, I probably wouldn’t have started working on philosophy of religion, and I might’ve ended up living in a van down by the river next year. So I’ll thank him the best way a student can—by mounting a sustained attack on one of his favorite views.
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Chapter 1

Introduction

We live in a world of change. Glaciers form and melt. The green leaves of summer are red by the autumn and brown by the winter. People are born and die. All but the most stubborn nominalists admit that many objects have their properties only temporarily. And the nominalists only hedge because they don’t think there are any properties. So (at the very least!) just about all of us believe in some kind of property change. Nevertheless, there is substantial disagreement in metaphysics over what kinds of objects undergo property change, what it is for a property to be temporary, whether existence is temporary and how spacetime itself changes, if at all.

We can distinguish the foundational theories of time based on their stances on these issues. A-theorists of time and change tend to think that many objects endure through change (they change without being “spread out” in time) and temporary properties need not be relations between an object and a time. To take a toy example: they’d say a particular ice cube is melting just in case it is cold and solid and the very same, numerically identical object will be warm and liquid some time in the future. B-theorists view time as spread out the same way we ordinarily, pre-relativistically think space is spread out.¹ According to the B-theories, there is a multi-dimensional manifold that contains all temporal objects. B-theorists explain property change by

¹The terms “A-series” and “B-series” were coined by McTaggart at the turn of the last century, and the rough distinction has stuck. See McTaggart (1908). The A-series distinguishes between past, present and future times, events and objects. The B-series distinguishes between earlier and later times, events, and objects. A-theories of time postulate fundamental A-series distinctions. B-theories do not.
appeal to this manifold, and here we face further theoretical choices. *Relational B-theorists* think all changing properties are relations between an object and a region of the manifold. An ice cube changes because it is cold at a a region of spacetime and not cold at a different region. In contrast, *temporal parts B-theorists* think some changing properties are not time-relational; instead, changing properties are all properties of a persisting object’s temporal parts. An object changes only if it has multiple temporal parts located at different regions of the manifold with varying properties. According to the temporal parts theory, an ice cube melts because it has a part that is cold and another part that is not.

This debate over property change is the most basic conflict between A-theorists and B-theorists. But there is also considerable disagreement about whether and how objects change with respect to existence. Most philosophers nowadays are unwilling to treat existence as just another property of objects, so change in existence cannot be just another species of property change. Still objects are created and destroyed, come to be and cease to be. It seems natural to suppose I haven’t always existed. Dinosaurs no longer exist. My great-grandchildren are yet to exist. How do we account for this? Again there are choices. *Presentist* A-theorists think that objects are frequently coming into and passing out of the world and all existents temporarily share at most one region of spacetime, the present. *Growing block* A-theorists think that objects come into existence, but nothing passes out of existence. Once something exists, it is forever more “stuck” in an expanding spacetime block. Presentists and growing blockers are united in that they both postulate a kind of ontological change over and above property change. In contrast, the B-theorists think nothing ever comes into or passes out of existence full stop. If an object ever exists at a region of the manifold, it eternally exists at that region. Objects merely change with respect to their locations in the spatiotemporal manifold. B-theorists are the paradigm examples of *permanentists*—philosophers who deny ontological change. Most A-theorists are
temporaryists— they believe in ontological change.

In this dissertation, I will try to convince you that there is no ontological change. In particular, I will argue that even those who are broadly sympathetic to the A-theoretic views of property change should rethink the usual accompanying dogma on change in existence. I build a case for a kind of permanentist A-theory that I call the minimal A-theory. Two features distinguish the minimal A-theory from presentism and growing block: i) it explains all change over time as a species of property change (namely, change in location relations), and ii) the theory can be expressed in a version of predicate logic. The minimal A-theory arises from my attempts to reconcile the simplest commitments of any A-theory with a plausible methodological assumption:

UNIVOCAL EXISTENCE: There is one natural sense of “exist” that is of primary interest to metaphysics, and it is denoted by quantifiers.

Defenders of this principle are sometimes called neo-Quineans after its founding advocate, W.V.O. Quine. I will explain the principle in the pages to follow. And I will argue that the minimal A-theory is the best option for neo-Quinean A-theorists. It may be helpful to have a visual representation of the choice points:

Figure 1.1: Positions in Time Debate
1.1 Chapter Summaries

I develop my case for the minimal A-theory over the four interrelated papers that compose this dissertation. Here is a synopsis:

Chapter 2: The Search for an Adequate Tense Logic

Traditional A-theories like presentism and growing block maintain that we live in a world of ontological change: they think objects come into or pass out of existence. And nearly all traditional A-theorists are neo-Quineans: they think there is a single, metaphysically important sense of existence and it is captured with existential quantifiers. There seem to be truths about objects that temporarily do not exist. Consider the claim “There were dinosaurs.” Only someone with a very skewed historical perspective would deny this expresses a truth. But how do we formulate this claim without violating neo-Quineanism? Most traditional A-theorists opt for what I call the prophylactic operator strategy. They insist that some tense operators—namely $\mathcal{P}$ (“it was the case that”) and $\mathcal{F}$ (“it will be the case that”)—block the existential commitments of quantifiers in their scope. So just as “In a possible world, there are talking alligators” does not commit adherents to talking alligators, so “In the past, there were dinosaurs” does not commit adherents to dinosaurs existing.

In this chapter, I argue that the prophylactic operator strategy for tense operators fails. Using the strategy commits traditional A-theorists to a view on tense logic. But temporary existence cannot be consistently expressed in a tense logic built on standard quantification theory. The first half of the chapter develops the view of prophylactic tense logic and the expressive problem it faces. The second half suggests replies to the problem that attempt to save temporary existence by amending one or another component of standard tense logic. I argue that none of these amendments
yield a metaphysically adequate tense logic. So I conclude that the logical problem deserves a metaphysical reply. Neo-Quinean A-theorists ought to reject the standard account of ontological change. In the process of developing the logical argument against temporary existence, I also elucidate some important disanalogies between modal and temporal metaphysics.

Chapter 3: The Minimal A-Theory

Chapter 2 argues on logical grounds that A-theorists cannot maintain both the temporary existence assumption and the univocal existence assumption. This chapter argues for the same conclusion on metaphysical grounds. Presentists often claim that ontological change is a datum of common sense. But I think there are good metaphysical reasons to believe in permanentism—the principle that nothing changes with respect to existence. B-theorists of time (temporal parts theorists and relationalists) have long believed in a kind of permanentism. In this chapter, I argue for three claims. First, the Moorean “common sense” argument for temporaryism fails because temporaryism is not a valid generalization from plausible beliefs about objects coming to be or passing away. Second, non-Moorean considerations heavily favor permanent existence. And third, because of the foregoing arguments, A-theorists should explain our ordinary beliefs about objects coming to be and passing away by appeal to a special kind of change in spatiotemporal location relations rather than by appeal to change in existence. I develop an alternative to the traditional A-theories that I call the minimal A-theory. The minimal A-theory explains all change as property change.
Chapter 4: An A-Theory without Tense Logic

As far as I can tell, every practicing A-theorist assumes that her metaphysics requires a tense logic. We see in Chapter 2 that this leads to trouble for traditional A-theorists. In this chapter, I show that there is at least one A-theory that does not require a logic with tense operators. It remains to be seen whether this A-theory is more plausible than more traditional formulations like presentism and growing block. If the arguments in Chapter 3 succeed, I suspect it is more plausible. Nevertheless, I approach this chapter as more of a logical engineering problem. Tense logic and its attendant complications have long been an albatross for A-theorists. It is useful to have alternatives. My argument proceeds in four stages. First, I identify three lines of reasoning that might lead A-theorists to suspect tense operators are indispensable. Second, I develop a version of predicate logic with a novel tool for expressing tense. Third, I show how the minimal commitment of all A-theories can be expressed in this new logic. Finally, I suggest ways the logic can be extended to accommodate non-minimal A-theories.

Chapter 5: Change We Can Believe In (and Assert)

The concluding chapter tackles a problem faced by traditional A-theorists and minimal A-theorists alike. If A-theorists are serious about propositions as the contents of our beliefs and assertions, they ought to conclude that some propositions change truth value over time. Call this view propositional temporalism. Gareth Evans and Mark Richard have independent but similar arguments that propositional temporalists are forced to absurd conclusions about the contents of our beliefs and assertions. I call this the attitude problem for temporalism. In this chapter, I argue that the attitude problem only holds if we accept three doxastic and assertoric norms. I propose alternative norms that are friendly to propositional temporalists and, by extension,
A-theorists. And I argue that the best solution to the attitude problem requires abandoning the assumption that contributions to a conversation or investigation should persist indefinitely.

Appendices:

Appendix A provides a systematic overview of the logic proposed in Chapter 4. Appendix B suggests some postulates for explaining the flow of time on an operator-free A-theory.

1.2 A Note on Format

Though the chapters converge on support for the minimal A-theory, the dissertation is modular—each is presented as a paper that can be read in isolation of the others. Readers more interested in developments in tense logic will benefit most from Chapters 2 and 4. Readers less interested in formalism and more interested in straightforwardly metaphysical arguments can focus instead on Chapters 3 and 5. To achieve this modularity, I repeat some brief preliminary distinctions in the opening of some of the chapters, though in each case I emphasize and develop key assumptions differently.
Chapter 2

The Search for an Adequate Tense Logic

Metaphysicians should, I think, be applauded for efforts to be sensible. Here are two particular convictions about existence and time that seem worthy of defense:

**Univocal Existence:** There is just one way objects exist; and

**Temporary Existence:** Some objects come to exist or cease to exist.

I suspect before we do much philosophy we believe both principles, at least in these informal guises. And besides their street currency, the two principles have a respectable philosophical pedigree. Univocal existence is the battlecry of the neo-Quinean movement. Putting the assumption more precisely, neo-Quineans hold that quantificational expressions like “there is” “there are” “∃x” and “∃P” are how we express the single metaphysically important sense of existence. Quine, Lewis, van Inwagen, and Sider (among others) all offer defenses of the more precise univocal existence assumption, and it has come to structure many debates in contemporary metaphysics.¹ For instance, suppose you think there are numbers or universals. By univocal existence, you must think these exist in just the same sense as you, me, tables, electrons or whatever else you take there to be. There is no special realm for abstracta, and if you decide you are unwilling to admit that numbers or universals exist in the single important way, then you must be very careful in how you state theories that seem to quantify over them. Of course not everyone makes an effort to be levelheaded.

¹Quine (1953), Lewis (1986), van Inwagen (1998), and Sider (2009).
Neo-Meinongians like Priest and Parsons think there are several metaphysically important senses of existence. Deflationists like Carnap, Hirsch and Hofweber think there is no metaphysically privileged sense of existence. I’d venture a guess that these are minority positions in contemporary metaphysics, in part because we have trouble making sense of the Meinongian distinctions and in part because—contra the deflationists—many ontological debates seem substantive rather than plagued by ambiguity.

The second principle—temporary existence—is traditionally a component of the A-theories of time: theories that postulate some metaphysically important distinction between the present, past and future. By far the most common variety of A-theory is presentism, which holds that every non-abstract object is located at at most one region of spacetime (the present) and as time passes, objects or regions of spacetime cease to exist and come to exist. Prominent advocates of presentism include Prior, Bigelow, Zimmerman, Ludlow, Crisp, Markosian, and Merricks. A much smaller number of A-theorists subscribe to the growing-block theory. According to the growing block theory, objects or regions of spacetime come to exist but never cease to exist: every non-abstract object is contained in an ever-expanding spacetime manifold. Broad, Adams, and Forrest all defend such a view, and as with presentism, it entails there are temporary existents. Call anyone who endorses the temporary existence principle a temporaryist, and call anyone who denies it a permanentist. B-theorists of time are the most prominent permanentists: they think of change over time the same way

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2Parsons (1980) and Priest (2005). It is harder to situate historical Meinong with the neo-Meinongians, because his views on existence and subsistence develop and change so much over the course of his writings. See Meinong (1960) for a statement closest to what I am attributing to the neo-Meinongians.

3Carnap (1956), Hirsch (2009), and Hofweber (2009a).


5Broad (1923), Adams (1989), and Forrest (2006).

6The terminology was suggested by Tim Williamson in his 2010 Methsene Lecture at Rutgers.
we ordinarily think of spatial variation. According to the B-theory, time is “spread out” in a multi-dimensional manifold, and the past/present/future distinction merely marks different parts of the manifold. The present isn’t ontologically special; it is merely the part of the manifold where we are. The past is the part of the manifold where dinosaurs are. The future is the part of the manifold where the 55th President of the United States is. An object does not cease to exist just because it is at a temporal remove from us, any more than an object ceases to exist when it changes spatial location. The B-theory strikes many initially as a radical thesis about change, in part because it seems like creation, destruction, coming to be and passing away are more profound than mere location change. Detractors complain that dinosaurs are not just in some other corner of spacetime; they don’t exist. Still the B-theory has been a powerful contender in recent decades, and it has many noteworthy defenders including Russell, Quine, Lewis, Price and Sider.7

In this essay, I will make a determined effort to be both sensible and formally precise. And I will fail. As it stands, there is no way to uphold neo-Quinean and temporaryist scruples within the framework of a consistent tense logic. Why? There is a particular logic-based strategy that neo-Quineans must pursue to reconcile temporary existence with apparent truths about merely past and future objects. I call this the prophylactic operator strategy. In Section 2.1, I will explain the prophylactic operator strategy and the view of tense logic that underwrites it. In Section 2.2, I will outline a serious challenge to the strategy: in any tense logic with a standard quantification theory, temporary existence is false. I call this the import problem for tense logic because the problem arises from theorems that allow existential quantifiers to be imported into the scope of prophylactic operators. In Sections 2.3 and 2.4, I

7Russell (1915), Quine (1950), Lewis (1986), Price (1996), and Sider (2001). Williamson is a permanentist A-theorist, and we will consider his views in Section 2.5.
will develop two possible formal responses to the import problem and argue that neither of the resulting tense logics vindicate univocal, temporary existence. My failure motivates us to consider alteratives to the temporaryist A-theories, and in the final section I will survey some of these implications.

2.1 Aliens and Prophylactics

Every so often during the Congressional budget season NASA optimistically announces “There will be a Mars research station in our generation.” We can certainly question the political expediency or scientific viability of the prediction. We might equally wonder about its logical form. Suppose you are a neo-Quinean temporaryist space enthusiast. You think the Mars station does not exist. But you trust the government and believe that the station will come to be. What precisely do you believe?

The claim about the Mars Station is an example of a claim about a temporal alien, an object that doesn’t exist but once existed or will exist in the future. There seem to be many true claims about temporal aliens. There were dinosaurs. There was a Memphis rockstar named “Elvis.” A Mars station will be built eventually. To capture the logical form of these claims while dodging unwanted existential commitments, many neo-Quinean temporaryists make use of prophylactic operators. A prophylactic operator is any operator that blocks existential commitments of quantifiers in its scope. The truth-functional negation operator is the ultimate prophylactic—a quantified sentence in the scope of a negation operator commits us to non-existence. But there are also common non-truth-functional prophylactics, like mere possibility and mere fiction operators. For example, almost nobody thinks that “In the Battlestar Galactica fiction, there is a Cylon” entails that Cylons exist. Rather, Cylon existence is only true according to the Battlestar fiction. We can try to codify this distinction
in logic. Let $\mathcal{B}$ abbreviate the “in the Battlestar fiction” operator. The Cylon claim is seemingly ontologically innocent because in the logic-ese formulation—$\mathcal{B}\exists x C x$—the quantifier is blocked by prophylactic $\mathcal{B}$. Neo-Quinean Battlestar fans rest easy so long as $\mathcal{B}\exists x C x$ does not entail an unprotected existential claim like $\exists x C x$ (something is a Cylon) or $\exists x BC x$ (something is such that according to the Battlestar fiction, it is a Cylon).

To accommodate temporal aliens, we can extend the prophylactic assumption to tense operators like $P$ (“it was the case that”) and $F$ (“it will be the case that”), then treat the past and future much like we treat merely possible worlds or fictions. And so Neo-Quinean temporaryists formulate the Mars station claim as $F\exists x S x$: it will be the case that there is a Mars station. The $F$ operator allows us to make predictions about space stations without asserting their existence so long as $F\exists x S x$ doesn’t entail any unprotected quantified claims like $\exists x S x$ (something is a Mars station) or $\exists x FS x$ (something is such that it will be a Mars station). Call this general strategy for controlling existence claims the prophylactic operator strategy. This strategy goes back to the early days of the A-theory. Much of Prior’s early work on tense logic presupposes a tight analogy between tense and modality. And the strategy has been taken up by many contemporary defenders. For example, Zimmerman: “The presentist must, I think, be a serious tenser. At the very least, tenseless statements that require ontological commitment to past and future things must be treated as equivalent to tensed truths that do not.”

As should be clear, the prophylactic operator strategy forces adherants to develop views on intensional logics, because anyone who deploys this strategy must have an account of the entailment relations between prophylactic and non-prophylactic sentences. The translation scheme is useless if the allegedly prophylactic sentences always

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8See for example Prior (2003a).

entail existentially loaded ones. Modal actualists and *Battlestar* Quineans are thus forced into views on the entailment relations between sentences involving quantifiers and mere possibility or fiction operators. Neo-Quinean temporaryists must develop parallel views for the tense operators. A given logic is adequate for a metaphysical theory just in case the theory can be consistently expressed in the logic. Neo-Quinean temporaryists must assume there is a metaphysically adequate tense logic if they hope to be justified in using prophylactic operators to capture truths about dinosaurs, space stations and other temporal aliens.

Unfortunately, it is not clear that prophylactics work. The modal debate has long been plagued by problems involving the Barcan schemas. Many metaphysicians think that the logic of possibility is symmetric: if a proposition or sentence is possibly true, then it is necessarily possibly true. Every possible world is “accessible” from every other. This leads them to adopt versions of the S5 system of modal logic. But in S5, the following schema is a logical truth: $\diamond \exists x \alpha \rightarrow \exists x \diamond \alpha$. The result was first shown by Ruth Barcan-Marcus in the 1940s, and it subsequently set the agenda for decades of work on modal metaphysics.\(^{10}\) Given the Barcan schema, allegedly prophylactic sentences like “It is possible for a Cylon to exist” ($\diamond \exists x Cx$) entail existentially loaded ones like “Something is a possible Cylon” ($\exists x \diamond Cx$). The first sentence is reasonable enough, but only a paranoid would believe the second. Call this the *export problem* for modal logic, since the trouble arises from the schema that exports the existential quantifier out of the scope of the allegedly prophylactic operator. There is a temptation to think this is an isolated problem for modal metaphysics, because few A-theorists think the correct tense logic is symmetric. Indeed, for many the primary philosophical motivation for the A-theory is their conviction that the future is open, and so some propositions about the future are *not* accessible from others.

\(^{10}\)Barcan-Marcus (1946).
And without a symmetry constraint, the Barcan schema doesn’t hold for $P$ or $F$.$^{11}$ This may seem like reason to be optimistic about the prospects for a metaphysically adequate tense logic, at least more optimistic than we are about our prospects for a metaphysically adequate modal logic.

### 2.2 Quantified Tense Logic and the Import Problem

But complacency is not warranted. Sure most A-theorists doubt that logic is symmetric, but what is the adequate logic? Suppose the neo-Quinean temporaryist tries to build her tense logic by extending standard predicate logic, adding axioms and rules for tense operators. This is a wise approach: predicate logic has proven its worth time and again in metaphysics. But she’ll quickly find that in any tense logic based on a standard quantification theory, the temporary existence principle is false. To see why, let’s look in some detail at the simplest standard tense logic available: Quantified Tense Logic K (QTLK).

For our purposes, a tense logic is any formal system that includes the four Priorian tense operators, two of which we have already met:

$^{11}$Actually even this conclusion is a bit quick; we can get an export problem in tense logic with less-controversial background assumptions. Suppose you think temporal structure is transitive and there are no branching times (that is, suppose you a simple, determinist A-theorist). Then it seems you should adopt this principle: $(\alpha \lor F\alpha \lor P\alpha) \rightarrow (((\alpha \lor F\alpha \lor P\alpha) \land G(\alpha \lor F\alpha \lor P\alpha) \land H(\alpha \lor F\alpha \lor P\alpha)). G$ abbreviates “it will always be the case that...” and $H$ is “it will always be the case that...” From this schema and standard predicate logic you can derive: $(\exists x(\alpha \lor F\exists x\alpha \lor P\exists x\alpha) \rightarrow \exists x(\alpha \lor F\exists x\alpha \lor P\exists x\alpha).)$ (I will skip the proof, but to see how it goes, define $\lozenge$ in the usual S5 schema as $(\alpha \lor F\alpha \lor P\alpha).)$ From the derived schema and “There was a dinosaur.” $(P\exists x D(x))$ we can infer “Something is a dinosaur, was a dinosaur, or will be a dinosaur.” $(\exists x D(x) \lor FD(x) \lor PD(x)).$ But temporaryists think all objects that ever were or will be dinosaurs are gone. Temporaryists must invalidate the derived schema to plausibly use the prophylactic operator strategy. And many will be happy to oblige by rejecting the no-branching-future constraint on models. One interesting upshot of this is, while presentists and growing blockers may have wished to remain neutral on the determinism/indeterminism debate, they now seem pressured to insist on an indeterminist semantics. I defer talking about these issues to later work, and I am grateful to Tim Williamson for some discussion on this point.
\[ \mathcal{P} \text{: “it was the case that”; and} \]
\[ \mathcal{F} \text{: “it will be the case that”}. \]

Add to this list the two “always” operators:

\[ \mathcal{H} \text{: “it has always been the case that”; and} \]
\[ \mathcal{G} \text{: “it will always be the case that”}. \]

(QTLK) results from adding axioms, definitions and a rule for these operators to a standard predicate logic with identity. A quick predicate logic refresher is in order, since from here out we will be discussing some of the components explicitly. We assume the usual axioms for propositional logic (PL) and add seven schemas, definitions and rules.

**Standard Predicate Logic (with Identity):**

Where \( \alpha \) and \( \beta \) are any wffs and \( x \) and \( y \) are any variables...

\[ \text{[Def] } \exists x \alpha \equiv \neg \forall x \neg \alpha. \]

\[ \text{[\forall] } 1 \text{ If } \alpha[y/x] \text{ is } \alpha \text{ with free } y \text{ replacing every free } x, \forall x \alpha \rightarrow \alpha[y/x] \text{ is an axiom.} \]

\[ \text{[\forall] } 2 \text{ } \forall x (\alpha \rightarrow \beta) \rightarrow (\alpha \rightarrow \forall x \beta) \text{ and } x \text{ is not free in } \alpha. \]

\[ \text{[=} 1 \text{] } x = x \text{ is an axiom.} \]

\[ \text{[=} 2 \text{] } \text{If } \alpha \text{ and } \beta \text{ differ only in that } \alpha \text{ has } x \text{ free in as many places as } \beta \text{ has } y \text{ free, then } x = y \rightarrow (\alpha \rightarrow \beta) \text{ is an axiom.} \]

\[ \text{[Modus Ponens] } \text{If } \alpha \text{ and } \alpha \rightarrow \beta \text{ are axioms or theorems, then } \beta \text{ is a theorem.} \]

\[ \text{[Universal Generalization] } \text{If } \alpha \text{ is an axiom or theorem, then } \forall x \alpha \text{ is a theorem.} \]

To get (QTLK), we then add six schemas for the tense operators:
\[ \text{[Def P]} \ P \alpha \equiv \neg H \neg \alpha. \]

\[ \text{[Def F]} \ F \alpha \equiv \neg G \neg \alpha. \]

\[ \text{[K1]} \ H(\alpha \rightarrow \beta) ightarrow (H\alpha \rightarrow H\beta) \text{ is an axiom.} \]

\[ \text{[K2]} \ G(\alpha \rightarrow \beta) ightarrow (G\alpha \rightarrow G\beta) \text{ is an axiom.} \]

\[ \text{[K3]} \ \alpha \rightarrow H F \alpha \text{ is an axiom.} \]

\[ \text{[K4]} \ \alpha \rightarrow G P \alpha \text{ is an axiom.} \]

And add a new rule of inference. Where \( \alpha \) is any pure theorem:

\[ \text{[Externalization]} \text{ If } \alpha \text{ is a pure theorem (not derived from premises) or axiom, then } G \alpha \text{ and } H \alpha \text{ are theorems.} \]

\[ \text{[Externalization]} \text{ is the tense logic equivalent of the Necessitation rule in modal logic.} \]

We assume all axioms and pure theorems are always true. (Necessitation holds that all axioms and pure theorems are necessarily true.)

The corresponding semantics for (QTLK) is formally elegant, if metaphysically tendentious (as we’ll see in Section 2.4). A model \( M \) is a quadruple \( \langle T, R, D, V \rangle \) where \( T \) is a non-empty set, \( R \) is an accessibility relation on members of \( T \), \( D \) is a non-empty set, and \( V \) is an interpretation function that assigns subsets \( D_n \) to \( n \)-place predicates in every well-formed formula \( \alpha \) relative to every \( t \) in \( T \), thereby determining one of the two truth-values (0 and 1). Where \( \mu \) is an assignment:

\[ [V \phi]_{QTLK} \ V_\mu(\phi x_1 \ldots \phi x_n, t) = 1 \text{ if } \langle \mu(x_1) \ldots \mu(x_n), t \rangle \in V(\phi) \text{ and 0 otherwise.} \]

\[ [V =]_{QTLK} \ V_\mu(x = y) = 1 \text{ if } \mu(x) = \mu(y) \text{ and 0 otherwise.} \]

\[ [V \neg]_{QTLK} \ V_\mu(\neg \alpha, t) = 1 \text{ if } V_\mu(\alpha, t) = 0 \text{ and 0 otherwise.} \]

\[ [V \rightarrow]_{QTLK} \ V_\mu(\alpha \rightarrow \beta, t) = 1 \text{ if } V_\mu(\alpha, t) = 0 \text{ or } V_\mu(\beta, t) = 1 \text{ and 0 otherwise.} \]

\[ [V \forall]_{QTLK} \ V_\mu(\forall x \alpha, t) = 1 \text{ if } V_\rho(\alpha, t) = 1 \text{ for all } x\text{-alternatives } \rho \text{ of } \mu \in D \text{ and 0 otherwise.}^{12} \]

\(^{12}\)Where an “\( x \)-alternative of \( \mu \)” is identical to \( \mu \) except at most in uniformly assigning a different member of the domain to the free variable(s) in \( \alpha \) than \( \mu \) does.
\[ [V \exists]_{QTLK} V_\mu(\exists x \alpha, t) = 1 \text{ if } V_\rho(\alpha, t) = 1 \text{ for some } x\text{-alternative } \rho \text{ of } \mu \in D \text{ and 0 otherwise.} \]

\[ [VP]_{QTLK} V_\mu(\mathcal{P} \alpha, t) = 1 \text{ if } V_\mu(\alpha, t') = 1 \text{ for some } t' \text{ such that } R(t', t) \text{ and 0 otherwise.} \]

\[ [VF]_{QTLK} V_\mu(\mathcal{F} \alpha, t) = 1 \text{ if } V_\mu(\alpha, t') = 1 \text{ for some } t' \text{ such that } R(t, t') \text{ and 0 otherwise.} \]

\[ [VH]_{QTLK} V_\mu(\mathcal{H} \alpha, t) = 1 \text{ if } V_\mu(\alpha, t') = 1 \text{ for every } t' \text{ such that } R(t', t) \text{ and 0 otherwise.} \]

\[ [VG]_{QTLK} V_\mu(\mathcal{G} \alpha, t) = 1 \text{ if } V_\mu(\alpha, t') = 1 \text{ for every } t' \text{ such that } R(t, t') \text{ and 0 otherwise.} \]

A wff \( \alpha \) is true in a model \( M \) if and only if \( V_\mu(\alpha) = 1 \) on each variable assignment for \( M \). A wff is valid if it is true on all models at all times.

(QTLK) is as simple a quantified tense logic as you can get. It has relatively few axioms, and we put no restrictions on the \( R \) relations among the models (for example, no restrictions on branching, and no requirements for symmetry or transitivity). Of course, most temporaryists will want to add further axioms and amend the semantic clauses to reflect their other views about the structure of time. Advocates of the growing block theory might dispense with the axioms and clauses for \( \mathcal{P} \) and \( \mathcal{H} \), given that they freely quantify over merely past existents and times. Any temporaryists who believe in the open future or believe that the past is subject to change will somehow need to amend \([K3]\) and \([K4]\) and the semantic theory that validates them. \([K3]\) rules out the open future, and \([K4]\) rules out changing the past. But set aside these worries for present purposes. The arguments to come won’t rely on these axioms at all; they’ll only make use of the far more innocent-seeming \([K1]\), \([K2]\), \([Eternalization]\), and \([\forall1]\).

Neo-Quinean temporaryists should be initially attracted to (QTLK) because it is minimally revisionary—again, it simply extends standard predicate logic, which has already proven quite useful as a tool for metaphysics. Why ruin a good thing? If only matters were so simple! In (QTLK), the converse tense Barcan schemas are theorems:
\[ [CBP] \exists x P \alpha \rightarrow P \exists x \alpha; \text{ and} \]
\[ [CBF] \exists x F \alpha \rightarrow F \exists x \alpha. \]

The proofs of these schemas are mostly straightforward. I’ll sketch one, condensing some derived rules in (QTLK) and abbreviating some derived rules for propositional logic with “PL.” For \([CBP]\):

1. \( \forall x \neg \alpha \rightarrow \neg \alpha. ([\forall 1]) \)
2. \( \forall x \neg \alpha \rightarrow \neg \forall x \alpha. (1, \text{Derived rule from [K1]: } \vdash (\alpha \rightarrow \beta) \rightarrow \vdash (\forall \alpha \rightarrow \forall \beta))\)
3. \( \neg \alpha \rightarrow \forall x \neg \alpha. ([\forall 2]) \)
4. \( \forall x \neg \alpha \rightarrow \forall x \neg \forall x \alpha. (2, 3, \text{PL Cut}) \)
5. \( \neg P \rightarrow \neg \exists x \neg \alpha \rightarrow \neg \exists x \neg P \rightarrow \neg \alpha. (4, [Def P], [Def \exists x]) \)
6. \( \exists x P \alpha \rightarrow P \exists x \alpha. (5, \text{PL Modus Tollens, PL } \neg \text{Elim}) \)

Parallel reasoning applies to \([CBF]\). And both are demonstrably valid in the semantics for (QTLK).\(^{14}\)

The converse Barcan schemas have devastating metaphysical consequences for temporaryists. Suppose there is at least one thing that hasn’t always existed. How do

---

\(^{13}\) Sketch of proof for the derived rule:

1. \( \vdash (\alpha \rightarrow \beta). (\text{Assume for conditional proof}) \)
2. \( \vdash \forall x (\alpha \rightarrow \beta). (1, [\text{Eternalization}]) \)
3. \( \vdash (\forall \alpha \rightarrow \forall \beta). (2, [K1]) \)
4. \( \vdash (\alpha \rightarrow \beta) \rightarrow \vdash (\forall \alpha \rightarrow \forall \beta). (\text{PL } \rightarrow \text{Intro, 1-3}) \)

\(^{14}\) Proof: \([CBP]\) is logically equivalent to \( \forall x \neg \alpha \rightarrow \forall x \forall \alpha \).

1. Suppose for reductio that for some time \( t \) and assignment \( \mu \), \( V_{\mu}(\forall x \forall \alpha \rightarrow \forall x \forall \alpha, t) = 0. \)
2. \( V_{\mu}(\forall x \forall \alpha, t) = 1 \) and \( V_{\mu}(\forall x \forall \alpha, t) = 0. (1, [V \rightarrow]) \)
3. \( V_{\mu}(\forall x \forall \alpha, t') = 1 \) for every \( t' \) such that \( R(t', t). (2, [V H]) \)
4. \( V_{\mu}(\forall x \forall \alpha, t') = 1 \) for every \( x \)-alt \( \rho \) of \( \mu \in D \) and every \( t' \) such that \( R(t', t). (3, [V \forall]) \)
5. \( V_{\mu}(\forall x \forall \alpha, t') = 0 \) for some \( t' \) such that \( R(t', t). (2, [V H]) \)
6. \( V_{\mu}(\forall x \forall \alpha, t') = 0 \) for some \( x \)-alt \( \rho \) of \( \mu \in D \) and some \( t' \) such that \( R(t', t). (5, [V \forall]) \)
7. \( \bot (4, 6) \)
8. \( V_{\mu}(\forall x \forall \alpha \rightarrow \forall x \forall \alpha, t) = 1 \) for all times \( t \) and assignments \( \mu \).

The same technique can be used for \([CBF]\).
we express the principle that there is at least one temporary object in the language of (QTLK)? Faithful neo-Quineans will initially express it using quantifiers and identity:

\[ (1) \exists x \forall y \neg(x = y). \]

Something is such that once it wasn’t anything. But (1) and \([CBP]\) entail:

\[ (2) \mathcal{P} \exists x \forall y \neg(x = y). \]

(2) says that it once was the case that something is nothing. You don’t have to know anything about the past to know this is absurd. Necessarily everything is something. Far from being a self-esteem mantra for objects, this is a theorem of standard quantified modal logics.\(^{15}\) A fortiori, there was never a time when something is nothing. The logical regimentation of negative ontological change—something ceasing to exist—will likewise yield a problem in (QTLK) by entailing that it will be the case that something is nothing. And note, these problems are grave even without assuming the results in modal logic. Even without the theorem that necessarily, everything is something, we face temporaryism’s baffling entailment that sometimes something is nothing. Perhaps if we read enough Heidegger—“the nothing noths”—we’ll come around to adopting this strange ontological posit. Short of this, temporary existence, univocal existence and (QTLK) lead straight to contradiction. Call this the import problem for tense logic, because the fatal blow is dealt by theorems that allow the

\[^{15}\text{Proof :}\]

1. \[ x = x. \ (\text{[= 1]}) \]
2. \[ \forall x \neg(x = y) \rightarrow \neg(x = x). \ (\text{Instance of } [\forall 1], \text{ with free } x \text{ replacing free } y) \]
3. \[ \neg \exists x(x = y) \rightarrow \neg(x = x). \ (\text{[Def } \exists x]\) \]
4. \[ \exists y(x = y). \ (1, 3, \text{ PL Modus Tollens}) \]
5. \[ \forall x \exists y(x = y). \ (4, [\forall 2]) \]
6. \[ \Box \forall x \exists y(x = y). \ (5, \text{ Necessitation Rule: } \vdash \alpha \rightarrow \Box \alpha) \]
existential quantifier to be imported into the scope of $\mathcal{P}$ or $\mathcal{F}$. Unlike the export problem, the import problem does not affect temporarists’ ability to make claims about temporal aliens. Rather, the problem affects how we express claims about existing objects that allegedly have undergone or will undergo ontological change.

The import problem is rarely discussed in contemporary work on time, but related issues have lingered in the background of the A-theory/B-theory debates since the early days of presentism. For example, Prior discusses issues with Barcan schemas in *Past, Present, and Future*, and more general problems accounting for temporary existence partly motivate his awkward System Q tense logic.\(^{16}\) System Q has three distinguishing features. First, Prior introduces two “statability” operators, $T\alpha$ (read as “the proposition that $\alpha$ will always exist”) and $Y\alpha$ (“the proposition that $\alpha$ has always existed”). Second, he defines $G$ and $H$ using these new operators: $G\alpha \equiv (T\alpha \land \neg\mathcal{F}\neg\alpha)$ and $H\alpha \equiv (Y\alpha \land \neg\mathcal{P}\neg\alpha)$. Finally he rejects [*Eternalization*]. Though Prior doesn’t explicitly target the import problem with Q, the usual proofs of $[CB\mathcal{P}]$ and $[CB\mathcal{F}]$ don’t work in the logic. The system has that much going for it, but little else. Prior never explicitly gives a semantics for Q, but on most the straightforward theories, the system is incomplete.\(^{17}\) And to consistently state Prior’s formulation of the temporary existence principle, it seems he’ll need a non-standard quantification theory. In this case, Q turns out to be an extremely awkward variant of the logics I’ll argue against in Section 2.4. Because of these defects (and its overall clumsiness), System Q has found few explicit defenders in the years since Prior.

Here’s the scandal: while many temporaryists *since* Prior have openly embraced the prophylactic operator strategy, none have offered a metaphysically adequate tense logic to go with it. Can we succeed where Prior left off? In the remainder of this paper, I will sketch some solutions to the import problem. Each ultimately falls

\(^{16}\)See Prior 1967, 137-174. And for one of the clearest statements of System Q’s application to tense see Prior (2003b).

\(^{17}\)See Menzel (1991, 347)
short as a way of capturing univocal existence and temporary existence. But the suggestions yield new insight into the difficulties reconciling a quantified tense logic with these seemingly sensible metaphysical principles. These difficulties also elicit some important differences between the tense and modal debates. We begin with the least radical option: finding alternative translations of the temporary existence principle in (QTLK).

2.3 Reply 1: Reformulate Temporaryism?

The logic-ese translation of the temporary existence principle that we used to derive the import problem follows Russell’s convention of expressing existential claims using quantifiers and identity:

\( \exists x(\forall y \neg(x = y) \lor \exists y \neg(x = y)) \)

But the Russelian convention is not sacrosanct. Indeed, it has struck many as somewhat unfortunate, since it does not easily map onto the way existence claims are ordinarily expressed. Consider another quantified sentence in English:

\( \exists x \exists y(L(x, y) \land \neg(x = y)) \).

The second conjunct uses the identity predicate to distinguish the lover and the beloved. This poses a dilemma. Either the identity predicate is just another way of
expressing existence or the identity predicate denotes something else. If it denotes something else, then (5) seems to say more than what was intended with (4). (4) only seems to predicate a single relation, Loving, of two people. But if identity is just more machinery for expressing existence, then it seems redundant or worse; it confuses the univocal sense of existence that neo-Quineans mean to be handled by quantifiers alone. Either way, it would be nice to do without the identity predicate. Worries about this extra structure have driven some to consider alternatives to the Russellian convention, and these alternative raise opportunities for temporaryists. Can some different translation scheme be used to capture the logical form of temporary existence without triggering the import problem? If so, we might have a way of reconciling the metaphysics with (QTLK).

There are formal tricks for eliminating the identity sign in quantified claims. The most common introduces new interpretation rules. We usually interpret $\exists x$ and $\forall x$ inclusively: for formulae with multiple quantifiers like (5), it is possible for one object in the domain to serve as a value for both $x$ and $y$. Inclusive interpretations require an identity predicate whenever we want to make unique existential claims. But we might just as well have built standard predicate logic assuming an exclusive interpretation of variables. Weakly exclusive quantification theory prohibits a variable bound by a quantifier from taking the value of any other variable which freely occurs within the range of the quantifier. For example, consider:

$$(6) \ \exists y(F(x) \land G(y))$$

In a weakly exclusive quantification theory, $y$ can be assigned to any object in the domain except for any object assigned to $x$. Strongly exclusive quantification theory prohibits a variable bound by a quantifier from taking the value of any other variable (free or bound) that occurs within the scope of the quantifier. For example, consider:
(7) $\exists y((\exists x F(x)) \land G(y))$

In a weakly exclusive quantification theory, $x$ and $y$ in (7) could be assigned to the same object in the domain. In a strongly exclusive quantification theory, they cannot.

Hintikka (and Wittgenstein before him) has shown that many existential formulae can be reinterpreted using one of another of the exclusive quantifiers and omitting the identity predicate. Let $ex$ and $ey$ stand for strongly exclusive existential quantifiers. We can reformulate the love sentence in (5) as:

(8) $exeyL(x, y)$.

Voilá! Since $x$ and $y$ cannot take the same value, there is no need for the identity relation to distinguish the objects. And, as Hintikka notes, (8) seems a more straightforward regimentation of the English sentence than the Russellian alternative, (5). It eliminates the extra structure. So could the Hintikka method aid us in expressing temporary existence? It certainly seems (epistemically) possible that there be a different syntactic treatment of quantifiers that still underwrites a broadly neo-Quinean view of existence.

Unfortunately, the Hintikka trick doesn’t work for a special subclass of formulae, of which the formula expressing temporary existence is a member. Hintikka incautiously claims that “everything expressible in terms of inclusive quantifiers and identity may also be expressed by means of exclusive quantifiers without using a special symbol for identity.” But in his translation procedure, he explicitly prohibits “formulae which contain... subformulae of the form $x = x$, $x = y_1$, $y_i = y_j$, or $y_i = y_i$.”

Call any formula which contains no predicates besides the identity relation a bare

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$^{18}$Hintikka 1956.

$^{19}$Hintikka 1956, 235. Emphasis is his.

$^{20}$Hintikka 1956, 232.
formula. We need bare formulae to formulate claims about bare existence—highly general claims about what exists that do not make any reference to the properties of objects. But bare formulae must be excluded from Hintikka’s system, because if we try to eliminate the identity predicate from a bare formula using exclusive quantifiers, there will be nothing left for the quantifiers to bind. The resulting formula will not be well-formed. (Try this at home translating a simple formula like $\exists x(x = x)$. The Hintikka method yields the non-wff: $\text{ex.}^{21}$) The temporary existence principle we’ve been concerned with is a bare formula—it contains $x = y$ as a subformula. This is to be expected, because the principle expresses change in bare existence, not change in any properties an object has. So a tense logic built on exclusive quantification theory cannot express temporary existence. If we want to express bare existence claims using only quantifiers, we are stuck with the Russellian convention.$^{22}$

Would it do to relax the assumption that temporary existence is a bare existential claim? Suppose the temporaryist also thinks it is always true that there are no bare particulars. Always every object has at least one property. In logic-ese:

$$(9) \forall x \exists C(Cx) \land \forall x \exists C(Cx) \land \forall x \exists C(Cx).$$

Call this the no bare particulars principle. The no bare particulars temporaryist could express a principle that is at least truth-conditionally equivalent to temporary existence as follows:

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$^{21}$C.J.F. Williams notes an even more general problem with Hintikka’s system. Hintikka never defines what it is for a given formula to be a subformula. Presumably every formula is a subformula of itself. If this is the case, then there are several theorems of standard predicate logic that do not have translations in the Hintikka system. For example, $\exists x(x = x)$. As we’ve seen, the translation procedure cannot be applied to it. See Williams (1989, 31-33).

$^{22}$Bare formulae have another interesting logical/metaphysical feature: on epistemicist and super-valuational theories of vagueness, they are not susceptible of vagueness. I exploit this to provide an argument against temporary existence in Chapter 3.
\begin{align*}
(10) \ & \exists x (\mathcal{P} \forall C (\neg C x) \lor \mathcal{F} \forall C (\neg C x)).
\end{align*}

In English, something is such that it either once it didn’t have any properties or it will be that it won’t have any properties. Using the same technique, we can express that something came to be as:

\begin{align*}
(11) \ & \exists x \mathcal{P} \forall C (\neg C x)
\end{align*}

We don’t need the identity sign, and if we wanted, we could easily translate these claims in exclusive quantification theory. And if you already endorse the no bare particulars principle, this is the most general existence claim you are able to make. But the “no bare particulars” translation of temporary existence won’t solve the import problem. (11) and \([CB\mathcal{P}]\) entail:

\begin{align*}
(12) \ & \mathcal{P} \exists x \forall C (\neg C x).
\end{align*}

In English: it was the case that something had no properties. And (12) contradicts the no bare particulars principle in (9). The lesson? The import problem is not a problem for bare formulae per se; it is a problem for how we express our most general claims about existence and change.

### 2.4 Reply 2: Adopt a Free Tense Logic?

Barring some other ingenious translation scheme, the import problem forces us to consider more sweeping adjustments to \((QTLK)\). At this point, most readers will turn away from the terms and grammar of the logic and focus instead on its most controversial axiom schema. The overwhelmingly favored strategy for addressing the
parallel Barcan problems in modal logic targets the quantification theory in standard predicate logic. In particular, many blame the import and export problems in modal logic on $[\forall 1]$:

$$[\forall 1] \text{ If } x \text{ and } y \text{ are any variables and } \alpha[y/x] \text{ is } \alpha \text{ with free } y \text{ replacing every free } x, \forall x \alpha \rightarrow \alpha[y/x].$$

For our purposes, a free logic is any logic with a quantifier elimination schema other than $[\forall 1]$. Since its inception, classical quantification theory has been somewhat controversial. The rough idea behind $[\forall 1]$ is that at least one particular truth answers to any true universal generalization and, at the syntactic level, quantification is nothing more than the application of a single variable-binding operator. Free logicians contend that $[\forall 1]$ is invalid. Arguably the leader of the movement is Karel Lambert, who has published extensively on alternatives to classical quantification theory.\(^{23}\) There are several philosophical motivations for adopting a free logic. The most common is to block $\exists x(x = x)$ as a pure theorem. We can prove this in standard quantification theory using $[\forall 1]$. But why, free logicians wonder, should it be decided by logic alone that at least one object exists?

Free logicians like Lambert propose a new elimination schema as an alternative to $[\forall 1]$:

$$[\forall 1Free] \text{ If } \alpha \text{ is any well-formed formula, } x \text{ and } y \text{ any variables and } \alpha[y/x] \text{ is } \alpha \text{ with free } y \text{ replacing every free } x, \text{ then } \forall y(\forall x \alpha \rightarrow \alpha[y/x]) \text{ is an axiom.}\(^{24}\)$$

\(^{23}\)For an overview of philosophical motivations for free logic, see Lambert (2001) and Lambert (2003).

\(^{24}\)Assuming we restrict values of $\alpha$ to closed formulae and allow vacuous quantification, $[\forall 2]$ is acceptable as is for free logic. $[\text{Eternalization}]$ must also be restricted to closed formulae.
[∀1Free] is distinctive because it only allows closed formulae as theorems. Without open formulae, the proof that at least one object exists fails. This idea for a closed quantification theory goes back still further to Quine’s Mathematical Logic, and it finds support among logicians who worry about whether systems with open formulae theorems are genuinely truth-preserving. As an aside: it is hard to see how open formula are true or false, given that they are neither sentences nor do they seem to express propositions. I will not address the status of open formulae in any great detail here except to indicate this as an independent motive for [∀1Free]. I suspect the most we should demand of a logic is that it is weakly truth-preserving—no theorems are false—rather than strongly truth-preserving—all theorems are true. And note that open formulae can be quite useful in metaphysics. For example, a common, nominalist-friendly formulation of the principle of extensionality makes use of an open schema. Where X and Y are second-order variables: ∀x(Xx ↔ Yx) → (X(y/x) ↔ Y(y/x)). This formulation of extensionality is just a special case of [∀1]. Still, we are not concerned so much with philosophy of logic here, but rather whether a logic built on [∀1Free] can dodge the import problem. And in its metaphysical applications, free logic shows some initial promise.

Free Tense Logic Explained

[∀1] is the first step in the derivations of [CBP] and [CBF] surveyed in Section 2.2. Hence, it is partly responsible for the import problem. Kripke was the first to realize that a kind of free logic could block the Barcan schemas in modal logic. For

25 For example, Bostock (1997).

26 Predicates are extensional just in case any co-referential terms can be subsituted salva veritate. Quine suggests this form for extensionality in Word and Object; it is the predicate logic cousin of the now common extensionality axiom in set theory. See Quine (1960b, 151).

27 Kripke (1971).
somewhat technical, tangential reasons, a different quantifier elimination schema is often used to develop free modal logics.\(^{28}\) It involves an extra universal quantifier:

\[ \forall \text{Free} \] If \( \alpha \) is any well-formed formula, \( x, y, \) and \( z \) any variables and \( \alpha[y/x] \) is \( \alpha \) with free \( y \) replacing every free \( x \), then \( \forall z \forall y (\forall x \alpha \rightarrow \alpha[y/x]) \) is an axiom.

Call the logic with a proof theory mirroring (QTLK) except for replacing \([\forall 1]\) with \([\forall \text{Free}']\), Free Tense Logic \( K \) or (FTLK). Little is written about \([\forall \text{Free}']\)’s application to tense logic, and nothing by Kripke himself. So it is best to think of (FTLK) as a Kripke-inspired system we’re developing rather than one he would advocate.

We cannot derive \([CBP]\) or \([CBF]\) in (FTLK). This is a limited success. But we need more to solve the import problem. Temporary existence is supposed to be a metaphysical truth. Thus some claims entailed by \([CBP]\) and \([CBF]\) are false, namely the bizarre past and future claims about something being nothing. So we ought to be able to show in our logic that that \([CBP]\) and \([CBF]\) are invalid, and this forces us to investigate the semantics that accompanies (FTLK).

To invalidate \([CBP]\) and \([CBF]\), we need to use a Kripke semantics. The characteristic feature of a Kripke semantics is its rejection of domain-inclusion: rather than drawing from a single domain, the semantics includes a “superdomain” and a function for generating subdomains from it. The valuation functions then draw from these particular subdomains. Kripke introduces the crucial metaphysical principle distinguishing superdomains and subdomains as follows:

Intuitively, suppose \( P(x) \) means “\( x \) is bald”—are we to assign a truth-value to the substitution instance “Sherlock Holmes is bald”? Holmes

\(^{28}\)See Fine (1983). If we drop the identity schemas from free intensional logics (as some philosophers wish to), we can no longer prove they are complete with respect to Kripke semantics (to be introduced shortly). But in a logic with \([\forall \text{Free}']\) we can. Not much hinges on this result for our purposes.
does not exist, but in other states of affairs, he would have existed... For the purposes of modal logic we hold that different answers to this question represent alternative conventions. All are tenable... Here... we assume that a statement containing free variables has a truth value in each world for every assignment of its free variables.\(^{29}\)

In other words, each world comes with a domain. In Kripke’s system, members of subdomains larger than the domain of actual objects (or in tense logic, the domain of present objects) can serve as the values for variables in quantified formulae. A tensed Kripke model is a quintuple \(\langle T, R, D, Q, V \rangle\). \(T\) and \(D\) are non-empty sets, as before, but in Kripke semantics \(D\) is not to be identified with the set of objects we take to presently exist. (More on this momentarily.) \(R\) is still a relation on members of \(T\). \(Q\) is a function that assigns subsets of \(D_{n\times t}\) to \(T\) resulting in a domain for each “time” \(D_t\). And \(V\) is an interpretation function that assigns \(n\) members of \(D_t\) to \(n\)-place predicates in every \(\alpha\) relative to every \(t\) in \(T\), thereby determining one of the two truth-values. The semantic clauses are the same as (QTLK) except for the quantifiers, which change to:

\[
[V\forall]_{FTLK} V_\mu(\forall x\alpha, t) = 1 \text{ if } V_\mu(\alpha, t) = 1 \text{ for every } x\text{-alternative } \rho \text{ of } \mu, \\
\rho \in D_t \text{ and 0 otherwise; and} \\
[V\exists]_{FTLK} V_\mu(\exists x\alpha, t) = 1 \text{ if } V_\mu(\alpha, t) = 1 \text{ for some } x\text{-alternative } \rho \text{ of } \mu, \\
\rho \in D_t \text{ and 0 otherwise.}
\]

Whereas in the original (QTLK) clauses, the “every \(x\)-alternative \(\rho\) of \(\mu\)” and “some \(x\)-alternative \(\rho\) of \(\mu\)” ranged over a single domain, \(D\), now the quantifiers are restricted to the individual subdomains generated by the \(Q\) function. Points (“times”) in the model can be given distinct domains. For this reason, Kripke’s system is often called a variable domain semantics in contrast to (QTLK)’s constant domain semantics.\(^{30}\)

\(^{29}\)Kripke (1971, 65-66).

\(^{30}\)A majority of those working in modal metaphysics seem to be variable domainers in one respect or another. Some prominent examples include Salmon (1987), Menzel (1990), and Bennett (2005).
If some times are allowed to have domains that are smaller than others, then 
\([CBP]\) and \([CBF]\) can be invalidated, the desired result for traditional A-theorists. 

Here is how the relevant countermodels work. Let \(\alpha\) be the wff that causes problems 
for temporaryism when plugged into the schemas: \(\forall y \neg(x = y)\). Let there be just two 
“times”: \(T = \{t_1, t_2\}\). Let \(t_2\) and \(t_1\) be mutually accessible: \(R = \{(t_1, t_2), (t_2, t_1)\}\). Let 
the superdomain have two objects in it: \(D = \{a, b\}\). The \(Q\) function in this model 
generates a subdomain with just one member, \(a\), and another with both objects: 
\(D_1 = \{a, b\}, D_2 = \{a\}\). \(D_1\) is the domain associated with \(t_1\), and \(D_2\) is the domain 
associated with \(t_2\). The problematic versions of the converse Barcan formulas are 
invalid on this model. Let \(t_1\) be the “present” and \(t_2\) be the “future”. I find diagrams 
helpful in interpreting the models:

Figure 2.1: A Countermodel to [CBF]

- \(<---------------\) • \(\sim \) •
- \(t_1\) “the present” \(t_2\) “the future”
- \(D_1: \{a, b\}\)
- \(D_2: \{a\}\)
- \(\forall y \neg(b = y) = 0\)
- \(\forall y \neg(b = y) = 1\)
- \(\exists x \forall y \neg(x = y) = 0\)
- \(\exists x \forall y \neg(x = y) = 0\)
- \(F\forall y \neg(b = y) = 1\)
- \(F\forall y \neg(x = y) = 0\)
- \(\exists x \forall y \neg(x = y) \rightarrow F\exists x \forall y \neg(x = y) = 0\)

The “present” in the above diagram is distinguished just because it is the point at 
which we are evaluating the sentences. \(\exists x F\forall y \neg(x = y)\) is true on the model, because 
it is true of \(b\) at \(t_1\). But \(F\exists x F\forall y \neg(x = y)\) is false. Now let \(t_1\) be the “present” but \(t_2\) 
be the “past.” Again, \(\exists x P\forall y \neg(x = y)\) is true on the model, because it is true of \(b\) at 
\(t_1\). But \(P\exists x F\forall y \neg(x = y)\) is false. (FTLK) thus formally answers the import problem,
because as long as it allows there to be members of the superdomain $D$ that are not assigned to the domain of “present” objects, the converse Barcan schemas are invalid. Again, this is progress. So is (FTLK) the metaphysically adequate tense logic?

**Metaphysical Problems with the FTLK Models**

Impressed with the formal machinery in (FTLK), we should not lose sight of what the theory requires. To invalidate the converse Barcan schemas, the free tense logician insists that there are domains for times $D_t$ such that they can grow and shrink. What exists with respect to one time does not exist with respect to another. Nothing strange here until you wonder whether this exact moment happens to be the time with the largest domain. Seems unlikely. We are very likely in a time like $t_2$ above, when there are truths about merely past or future existents. Indeed, this is why we are concerned with temporal aliens and tense logic in the first place. Suppose you are a thoroughgoing presentist and think everything is in the domain of the present. And suppose you think a new object will come to exist. In tense logic, one way to state this is:

\[
\mathcal{F}\exists x \neg \mathcal{P} \exists y (x = y).
\]

In English: There will be something such that nothing previously was it. To make a sentence like $\mathcal{F}\exists x \neg \mathcal{P} \exists y (x = y)$ come out true in (FTLK), you have to assert that there is a domain with a member such that the member is not one of the objects assigned to this time. For example, the temporal alien sentence would come out true in a model similar to the one above with one change: make $t_1$’s associated domain \{a\}, and $t_2$’s domain \{a,b\}. In this model, $b$ is such that nothing was it. But given the univocal existence assumption and thoroughgoing presentism, this kind of
countermodel is incoherent, because it requires that we claim that \( b \) is in the domain of \( t_2 \) even though when \( t_1 \) is present, \( b \) does not exist. Something, namely \( b \), is an indispensible part of the model, but doesn’t exist. Again, a diagram is helpful. The problematic domain here, is the domain associated with \( t_2 \):

![Figure 2.2: A Model for Aliens](image)

More generally, in times with reduced domains, we must assert the existence of domains that include objects we do not take to exist. This it is akin to asserting that there is a village in India with a unicorn in it, but that unicorn doesn’t exist. The fact that the unicorn is asserted to be in another place doesn’t make its existence any less mysterious. The fact that \( b \) is asserted to be in a distinct domain doesn’t make its appearance in the superdomain any less problematic. Call this the domain commitment objection to free tense logic.\(^{31}\) According to the objection, free tense logicians who believe there are truths about temporal aliens must assert the existence of something (in a domain) that does not exist. Therefore the logic is metaphysically

\(^{31}\)There is a related domain commitment objection to free modal logic. We find it in Plantinga (1976), Linsky and Zalta (1994), Williamson (1998), and Peacocke (2002). Priest also contends that variable-domain modal logic is possibilist, but he takes this as a reason to be more open to an existence predicate; see Priest (2005, 14).
inadequate. This issue generalizes across free intensional logics: to invalidate problematic schemas like the Barcan schemas or $\exists x (x = x)$, they make use of models with multiple domains. But on the most natural understanding of the univocal existence principle, there is just a single domain and existence is all-or-nothing affair. To put the point more as a challenge: the free tense logician needs some plausible account of what the invalidating objects in other, larger domains are, otherwise tense operators are no help in accounting for temporal aliens. And the account had better not entail that there is some object that does not exist.

A poor (though tempting) initial reply to the domain commitment objection insists that univocal existence doesn’t apply to quantificational expressions like “there is” when they describe the models. If we are allowed to use quantificational expressions in a loose, non-committing way in the formal semantics, then free tense logicians aren’t caught in a blatant contradiction. Bennett suggests this kind of approach to quantificational phrases in the semantics for modal logic. But the formal semantics is an indispensable part of the temporaryist’s total theory. It is question-begging and *ad hoc*—if not downright dishonest—to insist that univocal existence only applies to unprotected quantifiers when it will deliver the desired results.

A related, but more sophisticated reply shrugs off the demand to provide a formal semantics (or at least the demand to take the formal semantics seriously as an explanation of the behavior of prophylactic operators). Suppose the free tense logician is a semantic temporalist: he thinks there is no meaningful compositional semantics for tense operators. Prior and Fine advocate a kind of temporalism on behalf of presentists who object to the appearance of non-present times in the semantics for standard tense logics. The temporalist free logicians I imagine treat the Kripke “semantics”

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32 Bennett (2005, 308-309).

33 A problem arises for any traditional A-theorist who makes use of the constant domain semantic clauses for (QTLK), because these require quantifying over times that do not exist. For example, in (QTLK), a sentence like “It was the case that Thomas Jefferson is breathing.” is formalized as
as a useful heuristic for describing reasoning with tensed sentences, but they deny
that it is an official component of the logic and so deny that there are official proofs
that the converse Barcan schemas are invalid. Instead they’ll insist that it is enough
to adopt the proof theory for (FTLK), which does not facilitate the proofs of the con-
verse Barcan schemas. The trouble with this reply is it leaves the temporaryist with
a highly impoverished logic. The B-theorist opponents have no difficulty conducting
their metaphysics in a logic with both a proof theory and a formal semantics (since
they can do everything with just standard predicate logic). They are able to deter-
mine whether sentences in their theory count as logical truths, and they can describe
how reasoning about time depends on objects and their properties. The temporal-
ist free logician who shrugs off the interesting formal semantics has no such theory.
Moreover, without a semantic theory for tense operators, the prophylactic powers of
tense operators seem deeply mysterious. We are told initially that possibility, mere
fiction, mere past, and mere future operators are prophylactic because they restrict
the evaluation of existentially quantified formula to other worlds, mere fictions, and
other times. The temporalist I’ve proposed thinks this story about the behavior of
the operators is strictly speaking a fairy tale. Really we only understand the oper-
ators by their inferential role. So we can no longer explain that prophylactics work
by taking the sentence into some alien world, situation or time to be evaluated. And
without the semantic machinery to back it up, it is unclear how operators help us in
describing merely past or future objects without untoward existential commitments.

We give up the semantics at a great explanatory cost.

The semantic theory delivers the following truth conditions: \( P_B(j, t) = 1 \) if for some \( t' \) such
that \( R(t', t) \in V(B) \) and \( 0 \) otherwise. Jefferson breathed in 1776, so the English sentence
and its formalization are true. But according to presentists there is no time where Jefferson is
assigned to the predicate is breathing. Jefferson and 1776 no longer exist. See Prior and Fine (1977)
for an early version of a semantic temporalist response to the problem. Williamson (1998) also
expresses sympathy for this view. A more sophisticated option gaining ground in the modal debate
(and certainly applicable to A-theories) involves taking an agnostic approach to applied semantic
clauses, treating them as neither strictly true nor false. See Divers (2006).
A still better strategy accepts the Kripke semantics and tries to explain the elements of the models without asserting the existence of controversial temporal aliens. One version of this strategy insists that the members of the superdomain $D$ all exist, but the “alien” objects we use to invalidate the converse Barcan schemas are abstract objects, like numbers or set theoretic structures. The domain of objects in the present time is populated with spatiotemporally located concreta: electrons, tables, you and me. The $Q$ function merely assigns non-present abstracta to subdomains to generate the countermodels. As I read it, this is the spirit of Kripke’s suggestion in the passage proposing variable domain semantics. Recall he writes: “For the purposes of modal logic we hold that different answers to this question (of how to assign values to variables) represent alternative conventions. All are tenable...” (Emphasis is mine.)

When it comes to assigning objects to variables at merely possible worlds, Kripke suggests that we can adopt any convention we like, including the convention of assigning mathematicalia. All we need are objects that generate countermodels. And as long as we think the aliens are abstracta, we can assert their existence, deny they are in the domain of present objects, and show that the schemas are invalid. Timeless abstracta have never been a deep threat to presentism or the other traditional A-theories.

But this reply is still metaphysically inadequate. Sentences of the form $\neg\mathcal{P}\exists y(y = b)$ are supposed to express “it was the case that nothing is $b$” or, more informally, “$b$ is a temporary existent.” There are many goals one might adopt for developing a tense logic. Some might want the “tense” logic merely to prove interesting results about mathematical structures. In this case, $\mathcal{P}$, $\mathcal{F}$, $\mathcal{H}$ and $\mathcal{G}$ have nothing to do with time or change, they are merely operations that can be performed on sets. But we are investigating tense logic because we need it as a tool for expressing our theory of the world, in particular our theory of change and existence. We think the tensed quantified sentences express temporaryness. According to the proposed countermodel, $\exists y(y = b)$ is sometimes false, or at least false at some points in a model that represent
change over time. But if \( b \) is an abstract object, then it necessarily always exists. By our lights, \( \exists y(y = b) \) is always true. Putting an arbitrary abstract object “at a time” doesn’t change its nature.

Furthermore, why should reasoning about temporary existence be valid or invalid only in virtue of how the formal semantics assigns eternal abstract objects to sets? Note that I don’t mean to overstate or fetishize the role of the formal semantics. Few, if any, temporaryists expect the right-hand sides of any semantic clauses to provide meanings for the left-hand sides, where “meanings” are understood as the truth-conditions ordinary speakers would use to judge the truth-values of sentences or propositions (though this would be a significant upshot, given that temporaryists often claim to have the common sense view of time.)\(^{34}\) Nevertheless, the truth of temporary quantified sentences is somehow related to what is happening in the world, especially what is happening with spacetime. All temporaryists want a metaphysically acceptable way of describing how claims about change match up with the world. That is why temporaryists deny the logically regimented permanentist theories of change: the theories misrepresent the world by entailing that dinosaurs and space outposts exist in just the way you and I do. If the logically regimented metaphysical principles no longer need reflect the way the world is, then why be a neo-Quinean? Why not just concede (as deflationists since Carnap have urged) that the different parties in the A-theory/B-theory debate are just speaking different dialects of metaphysics-ese and refusing to translate each other? On the proposed reply to the domain commitment objection, tensed sentences can be valid, invalid, true or false in virtue of their relationships to objects that intuitively have *nothing* to do with the metaphysics of change.

Responding to these worries, the free tense logician might pursue yet another

\(^{34}\)A claim I dispute in Chapter 3.
strategy for explaining the countermodels. He may decide to press the modal analogy even further. Perhaps the extra objects required for the other domains are best thought of as “representalia”: components of abstract objects that represent past and future states of affairs. These representalia might be reducible to sets of propositions or properties, or they may just be *sui generis* abstracta. According to the representalia strategy, the temporal domains introduced by the $Q$ function aren’t filled with arbitrary abstracta, they are special-purpose devices that represent past and future states of the world. The controversial alien members of $D$ like dinosaurs and Mars outposts are components of those representations, but they do not exist in their own right. We can dodge the domain commitment objection because we take the representational devices described by the $Q$ function to exist. And as with mathematicalia, there seems to be no limit to the number of existing representational objects we might postulate. But unlike mathematicalia, they have something to do with change over time, because they represent histories or futures, just as possible worlds represent possibilities and fictions represent possible Cylons. And if just $b$ is a component of a representation, then it is sensible to think that it exists *according* to some times but not according to others, even if, in another sense, it is not a temporary existent. (Set aside the interesting and difficult question of how exactly we get particulars—like particular past dinosaurs—from the abstracta.) This representalia defense of tensed Kripke semantics is of a kind with a common move in the debate over modal semantics, and it is congenial to proposals offered by Zalta, Bigelow, Zimmerman, and Crisp in response to grounding problems for presentism.35

To my mind, this is the best suggestion yet. Still, the representalia approach to reconciling free logic with univocal existence raises new issues of metaphysical adequacy, issues that I suspect are unique to free *tense* logic and don’t similarly

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35Zalta is the most explicit about the logical application: Zalta (1987). For abstract times as answers to grounding objections in metaphysics, see Bigelow (1996), Zimmerman (1997), and Crisp (2007). For a sympathetic overview of uses for representalia in the modal debate see Bennett (2005).
plague free modal logic. Should we believe there are temporal representalia? The best argument for modal representalia that I know of is an indispensability argument due to Stalnaker. It runs roughly as follows. Clearly we are talking about something or other when we make claims about possible worlds, and theories that quantify over them are extraordinarily useful for semantics and for philosophical reasoning. So by neo-Quinean lights we should assume possible worlds exist. But we have choices in how we characterize their nature. Either the worlds we need for semantics and philosophy are abstract representalia or they are non-abstract concreta (as David Lewis proposes). If they are concreta, then it is unclear how we have any knowledge of possibilities. Afterall, knowledge of concreta usually comes from reliable causal interactions with them, but we never causally interact with merely possible worlds. If possible worlds are abstracta, then knowledge of them is no more and no less problematic than our knowledge of other purely theoretical entities (sets, numbers, universals, and the like). We have knowledge of possibilities. So we should conclude that the worlds we quantify over are abstract representalia.\textsuperscript{36} The Stalnaker argument crucially depends on there being no plausible concrete candidate for the title “possible world.” If concrete possible worlds could plausibly ground our knowledge of possibilities, there would be no need to postulate modal abstracta and his indispensability argument would fail.

There is no plausible-sounding parallel indispensability argument for times as representalia. Unlike merely possible worlds, we have causally interacted with other times. Our knowledge of the past is not based on apriori speculation, but on memories caused by past events. And considerations from physics pressure us to think of times as non-abstract. Our best modern physics seems to heavily favor substantivalism: the thesis that at least one region of spacetime exists.\textsuperscript{37} Regions of spacetime have

\textsuperscript{36}Stalnaker presses this kind of argument against Lewis’s modal realism. See especially Stalnaker (2003b) and Stalnaker (2003c).

\textsuperscript{37}For some background on substantivalism and General Relativity, see Maudlin (1993) and Belot (2005).
topologies we can study empirically, and spacetime regions interact with other objects. For example, according to General Relativity, massive objects alter the curve of nearby spacetime regions. On these conceptions of times, they behave like paradigm concreta. So even if there are representations of the past and future, these representations are not times in the sense of the times we quantify over when we make claims in physics or history. Temporal representalia thus face a powerful competitor for the title of “other time”—namely the regions of spacetime we previously inhabited, that caused our memories, that physicists study, and that are not plausibly thought of as abstracta. Whatever the Kripkean temporaryist postulates to be the members of $D$ and $Q$, it seems these are not the objects relevant to the metaphysics of time and change. Thus another version of the semantic problem afflicting mathematicalia targets temporal representalia: tensed sentences turn out to be valid, invalid, true, or false in virtue of their relationships to the wrong sorts of objects. At every turn, the free tense logician is forced into unreasonable claims about what exists and what truths about change over time depend on. This isn’t sensible metaphysics anymore.

2.5 My Favored Reply: Rethink Temporary Existence

Let’s review. Temporaryists need a quantified tense logic to be justified in employing the prophylactic operator strategy. Without some view of what tensed quantified sentences do and do not entail, they have no right to maintain that truths about merely past or future objects do not carry unwelcome existential claims. But no tense logic on offer is consistent with both neo-Quineanism and temporary existence. If we adopt a version of (QTLK), then tempoary existence is false. If we adopt a version of (FTLK), then we must either sacrifice univocal existence or admit that sentences about “temporary” states depend on irrelevant or unmotivated abstracta. So at the very least, the prophylactic operator strategy fails. Tense logic does not
easily accommodate both the sensible principles. This leaves us with some tough choices: (i) cease taking refuge in tense logic and simply deny there are truths about merely past or future objects, (ii) concede that existence is not univocal, in which case serious questions arise about the substantivity of debates between A-theorists and B-theorists, or (iii) rethink the principle of temporary existence that motivates this whole logical misadventure. I suggest it is time we more seriously consider the final option. How much of what matters in our beliefs about temporary existence could be saved by someone who denies that objects change with respect unqualified existence?

Linsky, Zalta, and Williamson propose that the best response to the troublesome Barcan schemas in modal logic is to simply accept them and conclude that every object is a necessary existent. Following Williamson, call this view necessitism. In some of his work defending necessitism, Williamson develops the modal arguments by drawing parallels to our reasoning about change over time. For example, he asks us to consider a case involving a river that has putatively ceased to exist, the Inn:

The analogy between modality and tense may help here. Although we cannot argue directly from one case to the other... the comparison often has heuristic value... Always everything is something. Therefore by (the converse Barcan schema), everything is always something. In particular the Inn is always something... What kind of thing has the Inn become, if it is no longer a river? Given that abstractness is not a temporary property, it has not become an abstract object. The best and most natural answer is just that the Inn was once a river; it is a past river.... Its characteristic properties concern its past; whether it continues to leave traces in the present is inessential to its nature.

Williamson goes on to argue by analogy that there are merely possible rivers. As I discussed above, I think there is an important disanalogy between worlds and times.

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Nevertheless, his suggestion for the temporal case has merit in its own right, and it deserves to be developed. Presentist and growing block A-theorists endorse temporary existence and face the grave challenge of supplying an adequate logic for stating the principle. As it stands, they have not met that challenge. In contrast, minimal A-theorists draw a fundamental distinction between the present and other times, but they reject temporary existence. According to the minimal A-theory, coming to be, ceasing to be, being created and being destroyed are all best understood as radical forms of property change. In particular, objects gain and lose their important intrinsic present properties, but objects never change with respect to the metaphysically interesting sense of existence. There is no import problem if we deny that anything changes with respect to existence. And minimal A-theorists have many attractive formal options. They are free to use tense logics built on standard quantification theory and the converse Barcan schemas. As I argue elsewhere, they may choose to dispense with tense operators altogether.\(^{40}\) They may even chose to remain agnostic on logic, given that they no longer need a prophylactic operator strategy. If the arguments of this paper succeed, such an account holds out the best hope for a substantive and logically respectable A-theory. If we can supply a plausible replacement for the temporary existence principle, we should.

\(^{40}\)See Chapter 4.
Chapter 3
The Minimal A-Theory

Timothy Williamson thinks that every object is a necessary, eternal existent. In defense of his view, Williamson appeals primarily to considerations from modal and tense logic. While I am uncertain about his modal claims, I think there are good *metaphysical* reasons to believe permanentism: the principle that everything always exists. B-theorists of time and change have long denied that objects change with respect to unqualified existence. But aside from Williamson, nearly all A-theorists defend temporaryism: the principle that there are temporary existents. I think A-theorists are better off without this added commitment, but I will not argue for that in any great detail here. Instead, I will contend that a very tempting A-theoretic argument for temporaryism is unsound. In the first half of the paper, I will develop the Moorean “common sense” argument for temporaryism and dispute its central premise, namely that temporaryism is a valid generalization from highly plausible beliefs about change. I will argue that given the pervasive vagueness in our ordinary beliefs about change and the background commitments of all A-theories, no party enjoys a significant Moorean advantage in the debate. In the second half of the paper, I will propose a permanentist A-theory that explains *all* change over time as a species of property change. The permanentist alternative performs well enough in accommodating common sense and it has better prospects for answering three objections commonly levied against A-theories.
3.1 Some Theories of Change

Here is a fun winter science and metaphysics experiment you can do with the kids. Make a small snowman in your yard. Name it “Frosty”. Carry Frosty inside your house and observe. Now ask two questions. First, what seems to happen to Frosty? This is the science component. (Hint: If you’ve been paying your heating bill, he should start to melt). Second, what is it fundamentally for an object like Frosty to melt? This is the metaphysics part.

Some philosophers (and some particularly cynical children) think this second question is misguided. There are many ways to describe how a snowman melts, and none are philosophically better than any other. Call this the deflationist theory of change. Deflationists think philosophers who debate the nature of change are often talking past one another. Eli Hirsch and Thomas Hofweber defend such a line.\textsuperscript{1} In contrast, anti-deflationists think that there are highly general facts about change, that these facts can be captured in a logically perspicuous language like predicate logic or tense logic, and that debates about change are substantive, at least when they are regimented in the right language. The debate between deflationists and anti-deflationists is an interesting one, but I won’t consider it in this paper. Instead, I will just assume with many other metaphysicians that there is an answer to the question of what change is fundamentally. Indeed, I will make a somewhat more specific assumption. Along with many metaphysicians, I endorse:

Univocal Existence: There is a single, fundamental sense of “exists” of interest to metaphysics, and it is denoted by the existential quantifier.\textsuperscript{2}

\textsuperscript{1}Hirsch (2009) and Hofweber (2009b).

\textsuperscript{2}Quine exegesis is no easy matter, but van Inwagen (1998) does an able job linking this methodological principle back to Quinean doctrines. Sider 2009 gives updated arguments for the principle. In the change debate, we see it explicitly assumed by A-theorists—Zimmerman (1998, 210) and Crisp (2004, 16-17)—as well as B-theorists—Sider (2001, 17).
The view is sometimes known as *Neo-Quineanism*. According to neo-Quineans, the debate about change is substantive if we can translate different theories of change into logic-ese and show that they must quantify over different domains. That’s what it is to have a debate about ontology, at least on the anti-deflationist picture I’m assuming.

Within the anti-deflationist/neo-Quinean camp, another debate rages between *A-theorists* and *B-theorists*. A-theorists are metaphysicians who think that there is an important distinction between the present and other times that a theory of change should reflect. There are usually two related components to an A-theory:

**Fundamental Tense:** There is a fundamental distinction between the present and other times, and expressing this distinction requires primitive tense operators like “it was the case that...” (usually abbreviated with \( \mathcal{P} \)), “it will be the case that...” (\( \mathcal{F} \)) or “it is always the case that...” (which I will abbreviate with \( \Box \)).

**A-Property Change:** Objects do not require temporal parts or time-relational properties to undergo change. Some objects have temporary non-relational properties and endure through change. Using the “always” tense operator, we can express the view most perspicuously: For some \( C \), \( \exists x (C(x) \land \neg \Box C(x)) \).

Here’s what many A-theorists say about Frosty as he’s melting. Frosty was frozen and man-shaped *simpliciter*. A little while later, Frosty—numerically the very same object—lacks both of these properties. The two A-theoretic principles are related because it seems that you cannot consistently express facts about A-property change without some kind of primitive tense. I suspect A-theorists can get by without the first assumption, but that too is a battle for another day.4


4In Chapter 4, I develop an A-theory that dispenses with tense operators in favor of tensed predicates. But the operator-free A-theory is irrelevant to the arguments of this paper since it presupposes permanentism.
B-theorists deny both components of the A-theory. They think of spacetime as a single, spread-out manifold and change as nothing more than variation across the manifold. Consider a common analogy. The Union Jack is blue in some places, red and white in others. We can say it “changes” colors at its different regions, but it would be incorrect to say the flag gains or loses colors simpliciter. The flag simply varies across spatial dimensions. B-theorists think the manifold varies likewise along spatiotemporal dimensions. There are two related components to a B-theory of change:

**NO FUNDAMENTAL TENSE**: All fundamental facts about change can be expressed without tense operators. Expressing facts about change merely requires predicates and quantification over objects and regions of spacetime.

**B-PROPERTY CHANGE**: Either all objects persist through change by having multiple temporal parts in the manifold or all objects change merely by instantiating varying relations to regions of spacetime. Nothing changes without temporal parts or varying spatiotemporal relations.

There are two predominant varieties of B-theory, depending on how you cash out the disjunction in B-property change. *Temporal parts* B-theorists think Frosty melts because he has temporal parts (or stage-theoretic counterparts) such that one is man-shaped and frozen simpliciter and another is not.5 *Relational* B-theorists think Frosty melts because he has varying relations to different regions of spacetime—he is man-shaped at a region of spacetime $t_1$ and it is not the case that he is man-shaped at region $t_2$.6 Relationalists think nothing just is man-shaped or frozen—changing properties must be held relative to a time. This debate between A-theorists and B-theorists is also very interesting, but I won’t consider it much in this paper. Instead,

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5We find versions of the temporal parts theory in Russell (1915), Quine (1950), Smart (1963), Lewis (1986), Price (1996), and Sider (2001). The view is sometimes called “four-dimensionalism.”

6Thomson (1983), van Inwagen (1990), and Gibson and Pooley (2006). Gibson and Pooley give a relativistic gloss on what it is for an object to have a time-relational property. The views are sometimes called “endurantist B-theories.”
I will just assume the A-theory. What I wonder is, should A-theorists think that their view (as stated) is a complete account of change? If we have the fundamental tense and A-property change principles, do we have all we need to theorize about the kinds of change in our world?

3.2 Temporaryism and Permanentism

Here is a reason to think not. If you let the experiment with Frosty go on long enough, two things will happen: (1) you’ll find yourself with an ever-growing mess on the floor, and (2) Frosty will be destroyed. How do we understand this last kind of change... Frosty’s destruction? It seems like change in existence. Given univocal existence, we can’t describe change in existence just as a kind of A-property change. The metaphysically interesting sense of “existence” is denoted by quantifiers, not an existence predicate. So to capture changes like creation, destruction, coming to be, and passing away, it seems A-theorists need to add a third principle to their theory of change:

TEMPORARY EXISTENCE: Some objects change with respect to existence. In logic-ese we express this using what I will call a bare existential sentence: $\exists x \neg \Box \exists y (x = y)$. The sentence is bare because the only predicate it uses is absolute identity.\(^7\)

It should be clear that all of the B-theorists deny the temporary existence principle. If an object is in the manifold, it never changes with respect to being in that region of

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\(^7\)Williamson coins these terms in forthcoming work. I learned them at his 2010 Mesthene Lecture at Rutgers, "Actualism Versus Possibilism, Contingentism Versus Necessitism." We can imagine an (albeit strange) A-theorist who thinks that temporarily there are only permanent existents. He might prefer temporary existence to be expressed as $\neg \Box \forall x \exists y (x = y)$. With minor amendments, all of the arguments to come should work equally well against this weaker form of the principle, and for ease of exposition, I will use the form above.
the manifold. So in the fundamental, unqualified sense of “exists”, everything exists eternally. For B-theorists, our beliefs about temporary existence are really beliefs about temporary location in the manifold. Many B-theorists will go even further, insisting that the temporary existence principle is incoherent, because it makes use of a fundamental tense operator, and there are no fundamental tense operators.\footnote{Frege and Russell seem to be the founders of this camp, because they argue that the content of a “tensed” sentence or thought must refer to a proposition with an explicit time reference. See Frege (1997, 331-333) and Russell (1978, 32).} But we are assuming the A-theory for present purposes, so we won’t worry about this.

Consider the opposing view:

PERMANENTISM: Everything always exists: $\forall x \Box \exists y (x = y)$.

Permanentism strikes most philosophers with A-theoretic sensibilities as completely insane. But recently there have been some strange ideas coming out of Oxford. Timothy Williamson argues in a series of papers that the best tense and modal logics commit us to both a kind of permanentism and necessitism, the view that everything necessarily exists.\footnote{For example: Williamson (1998), Williamson (2000c), Williamson (2002), and Williamson (2010).} Many read Williamson’s arguments and conclude so much the worse for his preferred tense and modal logics. No considerations from logic (disparaging emphasis) could ever move them to such wild ontological views. This is a kind of Moorean defense—some views are so plausible that no specialized philosophical considerations could displace them.

Moorean defenses are commonplace in a related, harder to formalize debate in philosophy of time: the debate between presentists and eternalists. Presentists are temporaryists who enhance the view by adding that all temporary existents are located in at most one region of spacetime, the present. Eternalists typically deny both
presentist assumptions. In defending his presentism, Dean Zimmerman insists that both components are data from common sense:

(1) Are there objective differences between what is past, present, and future? (2) Are present events and things somehow more “real” than those wholly in the past or future? I should like to respond “Yes,” to both questions. Affirmative answers sound obvious and commonsensical, at least to me. Indeed, I suspect that, for many of us, a belief in a deep distinction between past, present, and future can be given up briefly, if at all; and then only with a mighty effort of will.\(^\text{10}\)

Ned Markosian similarly asserts a Moorean advantage for presentism:

According to Non-presentism... non-present objects like Socrates and my future grandchildren exist right now, even though they are not currently present... I endorse Presentism, which, it seems to me is the “common sense” view, i.e. the one the average person on the street would accept.\(^\text{11}\)

I will not discuss the presentism/eternalism debate much here, except to note that presentism entails temporary existence but not vice versa.\(^\text{12}\) There are non-presentist temporaryists as well. For example, some philosophers subscribe to the “growing block” ontology: objects and regions of spacetime come to exist, but never cease to exist.\(^\text{13}\) If temporary existence fails, presentism and growing block are equally threatened. I am interested in the more basic debate between temporaryists and permanentists. Moorean presentists and growing blockers had better be Moorean temporaryists. But is temporary existence a Moorean fact?

\(^{10}\)Zimmerman (2008, 211).

\(^{11}\)Markosian (2004, 48).

\(^{12}\)At least neo-Quinean formulations of presentism entail the temporary existence principle.

\(^{13}\)For example, Broad (1923), Adams (1989), Tooley (1997) and Forrest (2006).
3.3 The Moorean Argument for Temporaryism

When you think a philosophical view is so obviously supported by common sense that only a madman would deny it, you ought to be able to give a Moorean argument for the position. The argument should show that a significant body of common sense beliefs favor a particular philosophical principle over its denial. A good Moorean argument for some principle $P$ follows this four-premise recipe:

(M1) Entailment: Highly plausible, common sense beliefs entail $P$. More specifically: There is a set of natural language sentences $M_E$ that express highly plausible beliefs about a certain domain, there is a set of sentences $M_L$ that are appropriate logical paraphrases of $M_E$, and $M_L$ entails $P$.

(M2) No Competition: The common sense beliefs are not misleadingly ambiguous (as some “common sense” tends to be). More specifically: There is no alternative set of logical paraphrases of $M_E$, $C_L$, such that $C_L$ is at least as appropriate as $M_L$, and $C_L$ doesn’t entail $P$.

(M3) No Defeat: The common sense that supports $P$ isn’t defeated by other plausible beliefs. More specifically: There is no set of natural language sentences, $D_E$, such that $D_E$ expresses beliefs at least as plausible as $M_E$, and the most appropriate logical paraphrase of $D_E$ entails $\neg P$.

(M4) Mooreanism: If a philosophical principle is entailed by sentences expressing highly plausible beliefs, the principle is undefeated, and it is not threatened by competing explanations, then it is very likely true. (At least, it is irrational to believe $M_E$ but deny $P$ once the relevant entailments are pointed out).

(C) So $P$ is very likely true. (Or at least it is irrational to deny it).\(^{14}\)

The recipe produces desirable results when used against thoroughgoing skeptical hypotheses in epistemology. Consider a toy example:

(M1-S) Here are two articles of common sense about hands:

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\(^{14}\)Lycan calls arguments of roughly this form *plausibility comparison arguments* and argues that they are the most charitable interpretation of the original Moore. See Lycan (2001). Like Lycan, I take “common sense” to mean (roughly) highly plausible for many people.
If Sullivan knows she has hands. No mere brain in vat knows she has hands.

And here is a plausible logical paraphrase of $M_E$. Let $H$ be the proposition that Sullivan has hands:

$$M_E \begin{cases} Sullivan \text{ knows she has hands.} \\ No \text{ mere brain in vat knows she has hands.} \end{cases}$$

$$M_L \begin{cases} K(s, H). \\ \forall x (B(x) \rightarrow \neg K(x, H)). \end{cases}$$

By contraposition, $M_L$ entails $\neg B(s)$. So common sense about hands entails that I am not a mere brain in a vat.$^{15}$

(M2-S) There is no more plausible way to capture the common sense about hands than $M_L$—at least no way that makes a difference to disproving skepticism.$^{16}$

(M3-S) Common sense about hands is not defeated by other plausible beliefs. In particular, no epistemological principle about evidence or justification is both as plausible as common sense about hands and entails that I am a brain in a vat.

(M4-S) Assume Mooreanism (as above)

(C) It is very likely that I am not a brain in a vat. (Or at least it is irrational to believe I am a brain in a vat and maintain common sense about hands).

This kind of argument against skepticism strikes me as convincing, and I certainly wouldn’t deny the weak epistemic principle that drives it.

Many temporaryists believe they are on the same footing with their metaphysics of change. The following argument seems appealing:

(M1-T) Consider a set of sentences expressing common sense about temporary objects:

$$M_E \begin{cases} The \ Sun \ came \ to \ be. \\ Frosty \ is \ being \ destroyed. \\ I \ am \ temporary. \end{cases}$$

$^{15}$If you think “no brain in vat knows she has hands” is not commonsensical enough, we can break down the assumptions even further, perhaps: “Brains in vats don’t have hands” and “If Sullivan knows she has hands, then Sullivan has hands.”

$^{16}$There is, of course, an equally good way of expressing “No mere brain in vat knows she has hands” as $\neg \exists x (B(x) \land K(x, H))$. 
This is just a representative sample of a very large, very plausible set of beliefs we have about objects being created and destroyed, coming to be and passing away. And here is a plausible logical paraphrase for $M_E$:

$$M_L \begin{cases} 
-\Box \exists y (y = \text{sun}) \\
-\Box \exists y (y = \text{frosty}) \\
-\Box \exists y (y = \text{sullivan}) 
\end{cases}$$

By existential generalization, each sentence in $M_L$ entails TEMPORARY EXISTENCE: $\exists x \neg \Box \exists y (y = x)$.\(^{17}\)

Having established the entailment, the Moorean temporaryist then makes the two defensive moves, which usually provoke the most controversy. The temporaryist insists:

(M2-T) No other paraphrase of $M_E$ is as plausible as $M_L$.

Many B-theorists deny (M2-T). They think our common sense is merely about location change.\(^{18}\) But the B-theoretic paraphrase seems initially somewhat worse than the temporaryist one. Suppose you say, “Elvis has ceased to be.” If I interpret this as “Elvis is located at a different region of spacetime” or “Elvis has ceased to be located now”, then it seems I have missed some important content that you meant to impart. The King hasn’t merely “left the building.” Elvis’s death *annihilated* him. At least, that is what temporaryists will contend. They’ll insist that our talk of such changes is most charitably interpreted as change in bare existence.

Further, the Moorean temporaryists insist on:

(M3-T) There are no philosophical principles that are as plausible as $M_E$ and contradict TEMPORARY EXISTENCE.

\(^{17}\)“Frosty will be destroyed.” and “The Sun came to be.” employ more fine-grained tense operators than $\Box$ but entail sentences that obey the more general schema.

\(^{18}\)For example, see Sider (2001, 212-215).
B-theorists and Williamson also resist this premise, usually pressing one of three specialized objections from logic, semantics or physics. But the trouble with the usual counterarguments—at least as far as the temporaryists are concerned—is that they depend on philosophical principles that are not obviously as plausible as the beliefs which entail temporary existence. Further, even if the principles often have contentious interpretations, and there are usually nearby alternative views that don’t directly contradict the temporary existence principle. Hence we find the persistent dialectical stalemate between traditional A-theorists and their critics. For example, when Williamson and B-theorists complain that temporaryist tense logic is highly convoluted, the temporaryists counter that we already need a complicated variable-domain logic to do modal metaphysics.\(^\text{19}\) When Williamson and B-theorists point out that names for merely past objects still seem to refer, the temporaryists argue that past names really pick out essential properties or are really disguised descriptions or Fregean senses.\(^\text{20}\) When B-theorists point out that presentist temporaryists cannot postulate enough regions of spacetime to do the physics of motion, the temporaryists insist that facts about acceleration are really facts about abstract trajectories or ersatz times.\(^\text{21}\) Overall, temporaryists contend that it’s okay to be surprised by your semantics, tense logic, or spacetime physics. Philosophy is hard! But it is not okay to believe in indestructible snowmen. An overwhelming body of highly plausible beliefs about creation, destruction, coming to be, and passing away outweigh whatever evidence the more specialized philosophical arguments offer.

\(^{19}\)For versions of the logic objections, see Williamson (1998) and Sider (2001, 76-78).

\(^{20}\)Williamson gives this argument in Williamson (1998, 265), though the point has been in the literature since Prior. For replies to the problem of past singular terms, see Prior (2003a, 16-17) and Markosian (2004). Prior thinks names for merely past or future objects are tacit descriptions. Markosian treats them as Fregean senses. Another approach treats them as names for uninstantiated essences. Inspiration for versions of the essence semantics can be found in Plantinga (1974) and Adams (1989, 29-31).

\(^{21}\)Sider gives a nice presentation of this problem in Sider (2001, 25-35). For an extended discussion of presentist answers to the motion problem, see Zimmerman (Forthcoming).
Having made the requisite defensive moves, temporaryists then apply a version of the Moorean principle:

(M4-T) If the temporary existence principle is entailed by sentences expressing highly plausible beliefs, the principle is undefeated, and it is not threatened by competing explanations, then it is very likely true. (Or at the very least, it is irrational to believe common sense about temporary objects but deny the temporary existence principle once the entailment is pointed out.)

And they conclude from the four premises:

(C) The temporary existence principle is very likely true. (Or at least it is irrational to deny TEMPORARY EXISTENCE and maintain common sense about Frosty, the Sun, and our own mortality.)

Call this the Moorean argument for temporaryism. Though it is rarely put so explicitly, I think this kind of reasoning explains the reluctance of most A-theorists to sign on to the Williamsonian project.

3.4 Who You Callin’ Crazy?

So much for setting up the Moorean argument. I intend to break the stalemate. As noted, critics usually focus on only the defensive moves in the Moorean reasoning. But I will argue for a stronger than usual permanentist claim—nobody with a concern for our ordinary reasoning about change should grant the first premise of the Moorean argument for temporaryism. Temporaryist A-theories are not consistent with a broad subset of our beliefs about creation, destruction, coming to be, and passing away. Given this, more specialized arguments from tense logic, semantics, and spacetime physics should carry much more weight in deciding the best theory of
change. My argument will take advantage of the pervasive vagueness in our ordinary beliefs about change. In brief outline: neo-Quinean A-theorists are committed to interpreting change in existence as always, necessarily a determinate matter—objects that change with respect to existence never go through a penumbral state such that it is indeterminate whether the change has happened. But the way we ordinarily speak and reason about coming to be, passing away, creation and destruction entails that these changes do involve penumbral states. This is a good reason for neo-Quinean A-theorists to think that our ordinary beliefs are—at best—tracking something other than change in existence. This argument is admittedly very quick. Here are the details.

Against Moorean Temporaryism

To warm up, compare three views an A-theorist might have on change with respect to redness:

TEMPORARY REDNESS: There is a temporarily red object. (In logic-ese: \( \exists x(R(x) \land \neg \Box R(x)) \).

DETERMINATE TEMPORARY REDNESS: Determinately something is temporarily red. (In logic-ese: \( \triangle \exists x(R(x) \land \neg \Box R(x)) \), where \( \triangle \) is the “it is determinate that...” operator.)

NON-DETERMINATE TEMPORARY REDNESS: It is not determinate that something is temporarily red. (In logic-ese: \( \neg \triangle \exists x(R(x) \land \neg \Box R(x)) \).)

It seems common sense about color change does not always entail determinate temporary redness. Why? Consider a thought experiment:

AN AUTUMN’S TALE: In August, a maple leaf—Leaf—is bright green.
In September, Leaf’s color has started to change. Casual observers describe it as “orangey-red.” It is indeterminate whether Leaf is red. *A fortiori*, it is indeterminate whether Leaf is both red and not always red. But in September, red color change is occurring. A-theorists think facts about color change are best expressed with fundamental tense and non-relational properties, along the lines of $R(\text{leaf}) \land \neg \Box R(\text{leaf})$. Leaf is evidence we live in a world of color change. But common sense about color change doesn’t always entail that *determinately* something is temporarily red. It isn’t yet determinate that Leaf is red and it may never be. At best, common sense about Leaf entails some kind of non-determinate color change. If A-theorists are right, it entails non-determinate temporary redness.

In processes of property change, many objects go through a penumbral phase—a phase such that they have neither determinately acquired the new property nor do they determinately lack it. When something becomes red, it goes through such a phase.

Now consider three very similar theses about temporary existence:

**Temporary Existence**: There is a temporary existent. (In logic-ese: $\exists x \neg \Box \exists y (x = y)$.)

**Determinate Temporary Existence**: Determinately, there is a temporary existent. (In logic-ese: $\Diamond \exists x \neg \Box \exists y (x = y)$.)

**Non-Determinate Temporary Existence**: It is not determinate that there is a temporary existent. (In logic-ese: $\neg \Diamond \exists x \neg \Box \exists y (x = y)$.)

It seems common sense about temporary objects does not always entail determinate temporary existence. Why? Consider another thought experiment:

*A WINTER’S TALE*: In February, a snowman—Frosty—exists. In March, Frosty has started to melt. Casual observers describe him as half-melted. It is indeterminate whether Frosty is destroyed by this melting. *A fortiori*, it is indeterminate whether Frosty survives and is a temporary existent. But in March, destruction is occurring. Temporaryists think sentences about destruction are sentences about change in existence, along the lines of $\neg \Box \exists x (x = \text{frosty})$. Frosty is evidence we live in a world of destruction. But common sense about destruction doesn’t always entail that
determinately something is destroyed or survives. It isn’t yet determinate that Frosty has been destroyed and it may never be. At best, common sense about Frosty entails some kind of non-determinate destruction. If destruction is characterized by temporary existence, then common sense about Frosty entails non-determinate temporary existence.

As with color change, when something is destroyed, it seems to go through a penumbral phase—a phase such that it is neither determinate that it has been destroyed nor determinate that it survives.

Herein lies the problem for temporaryists. Non-determinate temporary redness is metaphysically possible. But given a proper understanding of vagueness and the assumptions that A-theorists already endorse, non-determinate temporary existence is not possible. All of which lays the foundation for an argument against the first premise of the Moorean argument for temporaryism:

(P1) Assume for reductio (M1-T) of the Moorean argument: a large, highly plausible body of beliefs about creation, destruction, coming to be, and passing away entail temporary existence. It is not possible that the beliefs are true and temporary existence is false.

(P2) Necessarily and always, temporary existence entails determinate temporary existence. (Given only the common assumptions in the debate and a widely held assumption about indeterminacy that I’ll explain.)

(P3) There are worlds and times where objects undergo creation and destruction, come to be and pass away in just the way they do in our world. But in these worlds, determinate temporary existence is false because objects never exit the penumbral phase.

(P4) The temporaryist is committed to the common sense about creation, destruction, coming to be, and passing away necessarily and always entailing determinate temporary existence (From P1 and P2.)

(P5) Given P3 and P4, there are worlds and times where determinate temporary existence is both true and false. Contradiction.

(C) (M1-T) is false.
We should doubt the Moorean story of what our ordinary beliefs logically entail. Or so I will argue. But first, I must convince you of premises (P2) and (P3), which drive my objection. In Section 3.4, I will argue the for the necessary determinacy of temporary existence. Then in Section 3.4, I will describe a world where common sense about destruction is true, but determinate temporary existence is false. Some kinds of supervaluationists and epistemicists will believe they have a means for resisting my objection at (P3). I will outline their position in Section 3.4. But this supervaluationist/epistemicist “out” contradicts a package of highly plausible articles of common sense about temporary objects. So the argument fails to establish the “no defeat” premise.

On (P2): Determinate Bare Existential Sentences

As I have already noted, the temporary existence principle is captured with a bare existential sentence. It has no names and no predicates besides identity. Those who’ve reflected on neo-Quineanism (or, at least, have read their Sider) know that such sentences are not susceptible of indeterminacy. To see why, we must take a closer look at the two most prominent theories of indeterminacy: supervaluationism and epistemicism.

Supervaluationists think indeterminacy is a symptom of semantic indecision. A term is vague when there are multiple eligible precise denotations for it and our linguistic practices do not fix one particular denotation. A sentence is indeterminate if and only if it has a vague term and the sentence is true on one precisification

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22The argument of this section roughly follows a style of argument Sider uses on behalf of the temporal parts theory of change in Sider (2001, 120-139).

23Lewis and Fine are leading proponents of supervaluationism. See Fine (1975) and Lewis (1993). Most supervaluationists concede that “candidate” is also vague, and so they adopt higher order supervaluations as well. There are multiple precisifications for “candidate denotation” in a given context.
and false on another. Suppose Homer has 1000 hairs. Supervaluationists insist that “Homer is bald” is indeterminate because the set of individuals with at most 1005 hairs is one candidate denotation for “bald,” but so is the set of individuals with at most 990 hairs. So the sentence is true on one precisification of “bald” and false on the other. If a World Semantic Council were convened and vested with the power to stipulate that “bald” denotes just one particular set of objects, then “bald” would no longer be vague and “Homer is bald” would be either determinately true or determinately false.

Epistemicists deny semantic indeterminacy, usually because they want to preserve classical logic and semantics. Instead, they explain vagueness in terms of epistemic inscrutability.\textsuperscript{24} The denotations of \textit{some} terms are fixed by stipulation or in virtue of a term being highly natural (having no competing denotations). But, according to epistemicists, the denotations of \textit{all} other terms are fixed by exotic, arbitrary features of our language. Because of this, speakers cannot always know the precise denotations of their terms. On the epistemicist account, the predicate “bald” picks out one set with a determinate extension fixed at some point in our linguistic history. It was fixed in an arbitrary and highly contingent way. There are many candidate denotations that easily could have been fixed, so we’ll never discover the exact boundaries. Hence “Homer is bald” has a determinate truth value, but it is one we are not able to judge.

Critics gripe that epistemicists buy classical logic at the expense of what seems to be an incredible semantic thesis. But this difference matters little for our purposes. Epistemicists and supervaluationists agree on very little, but they at least converge on a necessary condition for indeterminacy:

\textbf{Multiple Candidate Denotations:} A sentence is indeterminate only if there are multiple candidate precise denotations for at least one of its terms and we cannot know which, if any, particular denotation is fixed by linguistic practice.

\textsuperscript{24}\textsuperscript{See Williamson (1994).}
According to the two most prominent accounts, indeterminacy is partly an issue of too many options.

The temporaryist sentence doesn’t meet this necessary condition, because each term has exactly one denotation. Consider each of the terms in $\exists x \neg \Box \exists y (x = y)$ in the order they appear. Neo-Quineans think existential quantifiers pick out the single, fundamental sense of “exists”. Without this assumption, the change debate succumbs to deflationist objections. So there is no indeterminacy in the quantifier expressions or their attendant variables. Negation is a logical constant—no room for indeterminacy here. All A-theorists are fundamental tensers, so they think that tense operators like $\Box$ have a single denotation—no room for indeterminacy here. That leaves only identity. Is identity sometimes semantically or epistemically indeterminate? Proponents of relative identity think our *ordinary* identity predicates are highly ambiguous. But this is only because they reject any denotation for an absolute identity predicate. Fans of relative identity would be forced to reject the formulation of the A-property change principle and the usual characterizations of endurantism, both of which rely on absolute, numerical identity. So relative identity is no friend to A-theories. And this exhausts the options for explaining any indeterminacy in temporary existence by appeal to multiple candidate denotations for a term.

If a sentence does not meet the necessary condition for indeterminacy, we should conclude that it is determinate. So given the most prominent accounts of indeterminacy, if temporary existence is true, it is determinately true. And A-theorists must think that the univocal existence and fundamental tense principles are necessarily true, if true. Neo-Quineans do not think existence is fundamental merely at our world—existence is fundamental at every (non-empty) world and time. A-theorists do not think it is an accident of our world that change cannot always be expressed with quantification over times—tense is an indispensible component to any way of

\[25\text{See also Evans (2002a).}\]
describing a dynamic spacetime system. In any world in which temporary existence is true, this elimination argument could be run to show that it is also determinately true. Necessarily, if our Moorean beliefs about change entail temporary existence, then they entail determinate temporary existence as well.

So far I have merely taken assumptions that all A-theorists already endorse and added the multiple candidate denotations principle. But perhaps some temporaryists will try to resist this step in my argument by rejecting this necessary condition. Some philosophers believe there is a kind of vagueness that doesn’t depend on multiple candidate denotations. Sojourners on this less-travelled route to indeterminacy maintain that a semantically determinate and epistemically scrutable sentence can nevertheless pick out a state of affairs such that it is indeterminate whether that state of affairs obtains. Call this the theory of *ontic vagueness*. Should neo-Quineans believe that \( \exists x \neg \Box \exists y (x = y) \) is one of the rare and elusive cases of ontic vagueness? Here I have little to offer beyond noting that I don’t see how. On certain abundant theories of properties, I understand what it would be for a state of affairs to be indeterminate. Some non-fundamental properties like *is a baseball player* have fuzzy extensions or instantiation conditions, so facts about baseball players are sometimes metaphysically indeterminate. But purely fundamental facts either obtain or they do not—that’s just part of what it is to be a fundamental fact. Neo-Quineans think existence is fundamental. A-theorists think tense captures a fundamental aspect of change over time. So neo-Quinean A-theorists should think facts about *bare* temporary existence are fundamental. The temporary existence principle makes a kind of bare existential claim. Even if there are some sentences that express indeterminate states of affairs, neo-Quineans should not think the temporaryist principle is one of them. Perhaps the best defense of bare existential indeterminacy would claim some kind of fundamental ontic indeterminacy in temporary quantum objects. But even if it turns out we can

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make sense of such a proposal, our beliefs about quantum objects (or waves or fields) are certainly not the stuff of common sense. These beliefs wouldn’t be appropriate inputs to a Moorean argument. Thus I doubt even the limited prospects for ontic vagueness will be of any help to temporaryists who think their view is common sense. So much for premise (P2).

On (P3): Common Sense and Indeterminacy

My defense of (P3) requires far less setup. We often speak and reason about processes of creation and destruction as though they are gradual and gradable, rather than sharp and binary. And because of this, there are worlds where we judge changes like creation and destruction to be occurring, but we’d never judge determinate temporary existence to be true. Consider another snowman possibility:

MUSHY’S TALE: There is a world where every object of common sense is an eternal being except for a lone snowman, Mushy. Mushy determinately exists at the first moment of time (January). But in March, he begins a gradual process of melting—just like the process Frosty undergoes in March of A WINTER’S TALE. The world ends half-way through the melting.

Here are three natural inferences to draw from MUSHY’S TALE:

1. If Frosty is being destroyed in March of A WINTER’S TALE, then Mushy is also being destroyed in MUSHY’S TALE. By hypothesis, they are undergoing the same process.

2. Like Frosty’s world, Mushy’s world is a world where something undergoes destruction. But in the last moments of Mushy’s world, it is indeterminate that Mushy is destroyed.

27 It isn’t even clear we should quantify over quantum “objects.” We’ve yet to settle the category for waves and fields.
3. Determinate temporary existence is false for every common sense object in Mushy’s world. Whatever process of change Mushy is undergoing, the change is in a penumbral phase. And by hypothesis, every other object of common sense belief always exists.

Whatever we are willing to say about Frosty’s destruction, we should say about Mushy’s destruction. If common sense about Mushy entails temporary existence, then it entails determinate temporary existence. In this world, common sense about Mushy’s destruction is true. Determinate temporary existence is false. So common sense about Mushy cannot entail temporary existence. So common sense about Frosty cannot entail temporary existence either. And a similar objection can be given for any article of common sense about creation, destruction, coming to be and passing away. Find the object’s counterpart in one of these penumbral worlds. In the penumbral world, the common sense holds true, determinate temporary existence is false, so the common sense cannot entail temporary existence. (M1-T) is false.

Precise Snowmen and Common Sense About Persistence

My argument against Moorean temporary existence assumes we agree that determinate temporary existence fails in Mushy’s world. But perhaps the temporaryist could resist my argument by rejecting this assumption. Perhaps it is not so strange to think the indeterminate sentences which express our ordinary beliefs about Frosty and Mushy entail that there are objects with shockingly determinate creation and persistence conditions. Some temporaryists will be tempted by this line:

*MUSHY’S TALE RETOLD*: “Mushy is temporary” and “Mushy will be destroyed” are best regimented as \( \neg \Box \exists x (x = mushy) \). But the name “Mushy” has many, very precise candidate denotations, though we don’t often acknowledge this. “Mushy” is just like “is bald.” One candidate denotation—\( Mushy_1 \)—is an object composed of exactly \( 10^{28} \) water molecules
arranged in a certain pattern. Mushy$_1$ has determinate persistence conditions of some sort: perhaps there is a precise number of water molecules and precise arrangement such that loss of these molecules or slight rearrangement would cause Mushy$_1$ to cease to exist. No matter what, it is always a determinate matter whether Mushy$_1$ exists. Another candidate denotation—Mushy$_2$—is composed of exactly $10^{28} - 1$ water molecules arranged in a certain pattern. Mushy$_2$ likewise has determinate persistence conditions. Common sense about Mushy is indeterminate because we cannot know which (if any) of the candidates is the single denotation of “Mushy.” That much of our ordinary reasoning is right. But we know at least one of the precise Mushys exists and is a denotation for “Mushy.” Otherwise the common sense would be determinately false. This precise snowman has determinate persistence conditions. So we must conclude that the indeterminate common sense about Mushy entails that it is determine that something temporarily exists, because it is determinate that one of the precisifications of Mushy exists and either hasn’t always existed or won’t always exist. (Just assume all of the candidate denotations must be temporary objects to count as candidates). So as long as we insist on a supervaluational or epistemicist semantics for ordinary names, we see that common sense entails some very determinate generalizations.

The supervaluationists and epistemicists I imagine think that (P3) of my argument against the Moorean can be resisted by showing that our common sense beliefs are really about very precise objects, though in our ordinary reasoning we gloss over this. With the appropriate semantics in the background, the sentences expressing ordinary beliefs entail both temporary existence and determinate temporary existence.

Supervaluationism or epistemicism may very well constrain our semantics for names. And it is fine for common sense, combined with logic and metaphysics, to lead us to surprising and previously unconsidered philosophical conclusions. But the reply misses the point. The trouble with Mushy’s world is that common sense dictates that there are times when the change goes indeterminate. Just as there are times where we think that a leaf is changing color but no determinate color change occurs, so there are times when objects undergo destruction but no determinate destruction occurs. Common sense dictates that whatever kind of change produces stars or destroys snowmen, the change is gradual. So the supervaluationist and epistemicist
conclusions run up against another, highly plausible domain of common sense—the common sense about how objects come to be and persist. For example, here are some other articles of common sense about change:

\[
D_E \begin{cases}
    \text{All stars came to be gradually.} \\
    \text{One snowman will be gradually destroyed.}
\end{cases}
\]

Most of us think it foolhardy to believe that any stars had precise times when they emerged from the cosmic miasma. Most of us doubt that any snowman has a precise number of molecules such that loss of just one more destroys him. When we speak and reason about changes like melting and stellar accretion, we always speak and reason as if they occur over indeterminate ranges of time. Here is the seemingly plausible logical paraphrase of \(D_E\):

\[
D_L \begin{cases}
    \forall x(\text{Star}(x) \rightarrow \neg \square \triangle (\exists y(y = x) \lor \neg \exists y(y = x))). \\
    \exists x(\text{Snowman}(x) \land \neg \square \triangle (\exists y(y = x) \lor \neg \exists y(y = x))).
\end{cases}
\]

Again, we have just followed the temporaryist in interpreting coming to be and destruction as pure changes in existence.\(^{28}\) But supervaluationists and epistemicists must deny these sentences. On the proposed metaphysics and semantics, every value for the variable has determinate creation and persistence conditions. So the common sense about gradual coming to be and destruction is superfalse. I submit that the common sense about stellar accretion and snowman destruction is just as plausible as the common sense about temporary objects running the original Moorean argument. We are as likely to assent to sentences like \(D_E\) as we are to \(M_E\). So even if temporaryists use supervaluationism for names to “save” (M1-T) of the Moorean argument, they

\(^{28}\) Compare to the paraphrases that would seem appropriate for “All stars gradually redden” and “One snowman will gradually turn yellow.” We’d regiment these as:

\[
D_L \begin{cases}
    \forall x(\text{Star}(x) \rightarrow \neg \square \triangle (R x \lor \neg R x)). \\
    \exists x(\text{Snowman}(x) \land \neg \square \triangle (Y x \lor \neg Y x)).
\end{cases}
\]
will still be forced to reject a huge swath of common sense beliefs about how objects come to be and persist. Even with a supervaluationist or epistemicist semantics for names, temporaryism has no legitimate claim to being the common sense view.

What is the upshot of all of this? The temporaryists contend that we should add the temporary existence principle to the A-theory because it is supported by an overwhelming body of common sense about change. But the beliefs that they appeal to all track processes of change that display indeterminacy. And once we try to account for this vagueness, we realize that many of these beliefs do not support the proposed A-theory. Temporaryism is just another specialized philosophical principle not a distillation from common sense. As such, it must stand or fall primarily on the philosophical advantages it confers. And to judge these advantages, we ought to look more closely at the permanentist alternative.

3.5 The Minimal A-Theory

I suspect that temporaryist A-theories have held their popular advantage because permanentism is improperly understood. So in these final two sections, I will lay out an alternative proposal—a way for A-theorists to explain coming to be, passing away, creation and destruction without appeal to the temporary existence principle. I call this alternative the minimal A-theory, because it explains all change with only appeal to property change. I will not attempt to give a Moorean argument for this proposal. I doubt any theory of change and existence enjoys a significant Moorean advantage. But I will argue that the minimal A-theory is not as crazy as you might initially suppose. And it has attractive prospects for dodging some specialized philosophical objections that have plagued the more traditional A-theories.

Recall that B-theorists often explain our beliefs about temporary existence as beliefs about a kind of property change, namely change in spatiotemporal location.
Relational B-theorists think objects come to be and pass away simply by having and lacking particular spatiotemporal locations. Frosty is destroyed because he has location relations with respect to February but lacks them with respect to June. Temporal parts B-theorists explain temporary existence using locations of temporal parts. An object changes with respect to existence just by having temporal parts at some regions of spacetime but lacking them at others. Frosty is destroyed because he has temporal parts at February and he lacks temporal parts in June. Both kinds of B-theory are examples of a “hidden-predicate” account of temporary existence. They insist our ordinary descriptions of objects coming to be or passing away often elide a location relation.

Minimal A-theorists take their cue from B-theorists. Most A-theorists ought to agree to the following principle of temporary location:

\[
\text{A-LOCATION CHANGE: Something is temporarily located at some region of spacetime. (In logic-ese: } \exists x \exists r_1 (LOC(x, r_1) \land \neg \Box \exists r_2 LOC(x, r_2)).)\]

The principle follows the structure of the A-property change principle introduced in Section 3.1. If location requires existence (and surely it must), temporary existence entails A-location change. But if objects can persist through the loss of all location relations, then A-location change does not entail temporary existence. The minimal A-theory I prefer endorses A-location change and permanent existence. Here is how minimal A-theorists tell the story of Frosty’s demise: he first loses the property is frozen, then loses the property is man-shaped, then loses the property is located somewhere. He never ceases to exist.

I think our beliefs about creation, destruction, coming to be, and passing away are adequately characterized on this model. Temporary location is susceptible to indeterminacy because the location relation is vague. An object is (partially) spatiotemporally located in all and only those regions in which it has a part. Most of the
objects we ordinarily believe in have vague boundaries and vague parthood relations. How are sentences like “Frosty temporarily has part A” indeterminate? An upshot of my proposal is we need not settle the matter. It may be a kind of supervaluational indeterminacy—there are many admissible precisifications of “Frosty,” “part” and/or “A” and our language has not selected any particular one. It may be a kind of epistemic indeterminacy—there is a precise but arbitrary and inscrutable denotation for at least one of these terms. Heck, it might even be ontically indeterminate! Perhaps some facts about parthood neither obtain nor fail to obtain. No matter. On any of these ways of characterizing the vagueness (or on other ways we have yet to cook up), vague parthood entails vague location. And note that all of the ways ordinary objects are created or destroyed involve making location and parthood relations more and less vague. When we judge it indeterminate whether an object has been destroyed, we judge its location relations to be vague. When we judge an object to have determinately ceased existing, we judge that it determinately lacks any location relations. Like other property change principles, the A-location change principle is susceptible to vagueness in just the way our ordinary beliefs would predict.

Will there still be precise cutoffs for objects being located somewhere or having parts? There might be if we understand the vagueness either supervaluationally or epistemically. Epistemicism entails that there are precise, inscrutable extensions for the relations “is part of” and “is located at.” And supervaluationists are still be saddled with supervalid generalizations like “some object has precise parts.” These results still contradict our ordinary, vague beliefs about persistence, and minimal A-theorists have nothing new to add here. Depending on how we ultimately explain the phenomenon of vagueness, we must jettison some of our ordinary beliefs about change. But this is no matter. The argument in Section 3.4 is meant to show that temporaryists do not enjoy any special advantage in explaining our ordinary beliefs about change. And that case has been established.
The minimal A-theory handles common sense well enough, and on the three issues that often inspire counterarguments from B-theorists and Williamson, the minimal A-theory fares much better than presentism and growing block. There is no problem stating A-location change consistently in a standard, straightforward quantified tense logic. Nothing in our theory of singular terms entails facts about the location of the referent. And as everything permanently exists, all regions of spacetime permanently exist. So there are ample regions of spacetime to serve as the cross-time relata in theories of inertial motion and acceleration. Presentists and growing block A-theorists typically assume that time “flows” because regions of spacetime change with respect to existence. How do we account for the “flow of time” on the new theory? One and only one region of spacetime has a special, temporary property—it is the only region that figures in any (untensed) location relations. Other times were locations of objects or will be locations of objects, but temporarily are not locations of anything. The spirit of the old A-theories is preserved, with new tools for addressing longstanding objections.

3.6 Objections to the Minimal A-Theory

Like Williamson, I think A-theorists have a lot to gain by going permanentist. Will the more traditional A-theorists respond by paring down their account of change? Once we’ve dismissed the Morean argument, the second biggest challenge facing minimal A-theorists is refuting principles that existence entails location. Many philosophers assume that if an object is ever spatiotemporally located, then it is essentially spatiotemporally located. Likewise, if an object is not spatiotemporally located, then it is essentially not spatiotemporally located.29 These principles are what minimal

29Some physicalists go even further, assuming unconditionally that everything is essentially spatiotemporally located.
A-theorists mean to resist. In this final section, I anticipate four objections in this spirit and argue that they are misguided. I’ll present them in order of least to most complex.

“But loss of spatiotemporal location is incoherent.”

OBJECTION: To account for our beliefs about change in existence, the minimal A-theorist treats spatiotemporal location as if it is just another property of objects. But it isn’t. To even make sense of property change, we must presuppose that the object undergoing the change remains in spacetime. Change occurs over at least two distinct times. If an object loses spatiotemporal location, then it is no longer in time. So it cannot complete the change. So change with respect to the property is located at some spatiotemporal region is impossible.

REPLY: The argument is unsound. Compare it to a parody argument against temporary existence. Change occurs over at least two distinct times. If an object ceases to exist, then it is no longer in time. So it cannot complete the change. So change with respect to existence is impossible. The faulty assumption in each case is that for there to be a fact about change, there must be an object before and after that change that is located in spacetime. No temporaryist should grant that assumption, and no minimal A-theorist will either. All that matters for property change is that there be an object that has a certain property and that object either lacked or will lack it. Tense is not to be reduced to spatiotemporal location.

“But I don’t always exist.”

OBJECTION: How do we account for the original beliefs that seem to support change in existence? The sentence “Elvis does not exist” obviously expresses a truth. On the
minimal A-theory, if an object exists, ever existed or ever will exist then it always exists. Elvis existed, but he does not always exist, no matter what his diehard fans would lead you to believe. In the same vein, I think someday I will die. When this happens, I will cease to exist. When I dwell on this fact, I feel somber. Sounds like the minimal A-theorists think I should buck up. According to the view, I am indestructible! The minimal A-theory fails to capture how important change in existence is to our ordinary beliefs, and location change is not even close to a suitable replacement.

REPLY: Here I side with a common B-theorist line. Before we do much speculative metaphysics or semantics, I doubt our ordinary reasoning about “existence” locks onto the wholly unrestricted, neo-Quinean sense of the term. When we consider the sentence “Elvis does not exist,” we think of it expressing the equivalent of a more qualified existence claim, something like “Elvis does not presently exist.” This smuggles in a temporary location relation. It expresses something equivalent to “It is not the case that Elvis exists and is located in the 2011 spacetime region.” And minimal A-theorists think this sentence expresses a truth. Elvis is not spatiotemporally located anywhere. So he is not here now. I think this is enough to save the core of your ordinary beliefs about Elvis. It is certainly enough to ensure you won’t bump into him in the supermarket.

And though you might be delighted to learn of your permanent existence, you may rightly suspect that the minimal A-theory’s guarantee of survival death is shallow. Here is how minimal A-theorists explain your attitudes toward death and other alleged “big” changes. All such attitudes are directed toward some kind of important property change: you simply don’t care about bare survival. When you fear your death, you fear lacking the property is alive. You fear losing the properties is able to converse with loved ones, is able to drink cold beer, and is able to view mountain sunsets. Existence is cheap if it doesn’t guarantee these other properties. Whether

30 An objection in this spirit (directed at B-theorists) can be found in Yourgrau (1987).
your existence metaphysically guarantees any interesting properties is another matter—one to which I now turn.

"But objects have essential properties."

OBJECTION: A location in some spacetime region or other is an essential property of many objects. Objects have other natural essential properties as well—some objects are essentially human, essentially physical, etc. Given these essences, the radical property change minimal A-theorists postulate is impossible for most, if not all, objects.

REPLY: We often see such essentialist assumptions at work in the objections offered against more Meinongian views of change (views that postulate two senses of "exist"). Zimmerman complains about a pseudo-Meinongian permanentist A-theory: "The... objects (the view) posits are too ghostly to be real. A painful headache cannot exist without being painful, a tanker explosion cannot exist without being violent and loud. Plato cannot exist while having neither body nor soul."31 Prior complains about Meinongians’ very thin view of existence: “this way of conceiving the relation between the real and unreal is profoundly misleading... it minimizes, or makes a perfectly arbitrary matter, the vast and stark difference that there is between the real and every form of unreality.”32 Likewise many B-theorists adopt a kind of spatiotemporal essentialism. In an early critique of Meinong, Russell writes: “We tend to ascribe existence only to whatever is intimately related to particular parts of space and time... for my part, inspection would seem to lead to the conclusion that, except for space and time themselves, only those objects exist which have to particular parts of space and time the special relation of occupying them. On a question of this kind

argument seems scarcely possible.”

There are several responses available to minimal A-theorists. First, note that some metaphysicians don’t share these essentialist sympathies, and so they simply deny the objection. It is hard to find uncontroversial examples of essences. You may think a certain retriever, Ginger, is essentially a canine. I believe Ginger was once a cluster of undifferentiated cells. I believe no cluster of undifferentiated cells can instantiate the property is a canine with any modicum of determinacy. So Ginger was not a canine whenever she existed. Ordinary “essences” of dynamic objects like is a canine or is rational are properties that emerge from gradual processes like every other kind of property change we ordinarily encounter. If existence depends on their instantiation, we face a variant of the problem that motivates the minimal A-theory: change in existence must be sharp and determinate, but change in these properties is susceptible to vagueness. I suspect all ordinary essences face a version of this objection.

Second, there is a way to accommodate some quasi-essentialist intuitions within the framework of a minimal A-theory. Say you have strong beliefs about essentiality of origins or kind membership, and this motivates your resistance to radical property change. Or say you are skeptical of bare particulars (objects with no intrinsic properties). You think Dean is a human with certain parents who could never become a poached egg and could never exist without any intrinsic properties. There is at least one way to accommodate your belief that is consistent with a minimal A-theory. Assume that besides temporary present properties like is a man and is an egg, there are past or future temporary properties like was a man and will be an egg. These

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33Russell (1978, 29).

34For example Dorr argues for a “no brute necessities” principle—metaphysical theories should try to reduce or eliminate primitive necessity claims. Many essentialist claims are brute necessities. See Dorr (2004) and Dorr (2008).
are distinct properties that are picked out by predicates with tensed copulae.\textsuperscript{35} We can group properties into classes. Perhaps there are classes of properties such that necessarily if an object has one of them, it has the others. One such class might be \{is human, is located in spacetime, is a non-egg\}. If Dean has the property is human, this entails that Dean is in spacetime and is not an egg. Another class might be \{was human, is a non-egg, will be a non-egg\}. If Dean was human, he is a non-egg and will be a non-egg. But Dean has none of these individual properties essentially. On the proposed view, ordinary “essential” properties are not properties that an object instantiates full stop whenever it exists. Rather they are properties whose instantiation are inextricably linked with other past, present and future properties. For lack of a better title, call this view \textit{limited essentialism}.\textsuperscript{36}

Limited essentialism preserves the core of the essentialist intuitions while remaining consistent with radical property change. The “essential” properties do not depend on existence, they depend on what other properties an object instantiates. Objects cannot change properties completely independently: property change happens all at once for entire classes. If property instantiation is vague, perhaps it is vague for the entire class. But objects are still able to persist through radical change so long as there aren’t classes like \{was human, will be spatiotemporally located\}. What explains these brute connections between properties? Who knows! I leave it to those with better essentialist intuitions than mine to develop the view. All that matters is that many quasi-essentialist connections pose no threat to the theory of change on offer.

\textsuperscript{35}For details on this proposal, see Chapter 4.

\textsuperscript{36}I am grateful to Dean Zimmerman for suggesting the limited essentialist view and still uncertain as to whether he could become a poached egg.
“But you said you were a Quinean!”

OBJECTION: This last objection is methodological. The minimal A-theory seems like easy ontology, where “easy” is meant as a perjorative. Easy ontologists are too permissive—they lack a principled way of reducing ontological commitments. What’s the point of being an anti-deflationist or a neo-Quinean if you believe in all sorts of objects with no causally efficacious properties? An upshot of “thicker” approaches to ontological commitment is that they can sometimes enforce an intimate relationship between our metaphysics, a naturalist-friendly epistemology, and the logical structure of our best theories. The logical structure of a candidate metaphysical theory entails that a certain set of entities exist and have interesting properties like spatiotemporal location. We then investigate the theory by searching for independent evidence of these existents. This simple epistemology drops out of any theory that allows objects to persist without having any causally efficacious properties. But now how do we tell if our metaphysical theories are any good? Despite their professions of neo-Quineanism, minimal A-theorists sound downright Meinongian in what they suppose exists. To paraphrase Quine, the minimal A-theory leaves us wondering how many merely past fat men there are.\footnote{Quine (1953, 4).}

REPLY: Some metaphysicians don’t mind being easy. They admit a single, privileged denotation for quantifiers and agree to all or almost all of the methodological considerations that commonly motivate neo-Quineans. They just think our best theories entail there are many, many objects because (of course!) there are truths about tables, chairs, properties, simples, and fictional detectives. So Jonathan Schaffer urges, “contemporary metaphysics, insofar as it has been inspired by the Quinean task, has confused itself with trivialities... the deep questions about numbers, properties, and parts (inter alia) are not whether there are such things but how.”\footnote{Schaffer (2009, 362). Emphasis is mine.}
and Hofweber are similarly deferential to our ordinary use of quantification, but they deny that questions of Quinean ontological commitment are of primary importance for metaphysics.\textsuperscript{39} There are options here for advocates of the minimal A-theory.

Still, I think minimal A-theorists should be wary of running with the easy crowd. And it is a mistake to think we must, merely because we deny that existence entails location. The minimal A-theory suffers unjustly from guilt by association. As far as I can tell, until now only Williamson comes close to proposing a minimal A-theory, and Williamson always presents his views on time alongside his account of necessary existents.\textsuperscript{40} For Williamson, respect for the simplest, strongest modal logic requires holding that for every possible object the world could contain, there is an object with a corresponding modal property. If there could be a talking alligator, then something is possibly a talking alligator. Williamson’s modal metaphysics seems suspiciously easy because we tend to be quite lenient with possible properties and objects.

But debates about time and tense logic are often too closely linked with debates about modality and modal logic. The epistemology of alternate possibilities is woolly and controversial. The epistemology of other times (at least past ones) is familiar and secure. We know what past times were like, and we know that we live in a world with some kind of change. It is not so transparent what modal structure the world has, if any. If modal truths turned out to rest solely on linguistic conventions, the world would not end. If whether there is change turns on mere linguistic convention—that would be a disaster. Which is to say, minimal A-theorists need not automatically endorse a certain modal metaphysics. And we need not be lenient with dynamic properties and objects. All the minimal A-theory requires is that whatever existed, exists, or will exist be admitted to always exist. It is still an open question whether dinosaurs ever existed or whether there were merely simples arranged dinosaur-wise.

\textsuperscript{39}Fine (2009) and Hofweber (2009a).

\textsuperscript{40}The account is developed most fully in a trilogy of papers: Williamson (1998), Williamson (2000a), and Williamson (2002).
Questions of mereology may still be “hard.” And it is still an open question what the changing properties are. True, the epistemology of these questions is more difficult than it may have been under the more naturalist variants of Quineanism. But nobody ever said this job was easy.

There is one way a minimal A-theorist may be forced to take on at least some of Williamson’s possibilia. Suppose a minimal A-theorist wanted to combine her view with an open-future theory. At present, it is possible that in 2012 Barack and Michelle Obama will have a third daughter and name her “Lisa.” And it is possible they won’t. If Lisa Obama does not determinately exist in 2011, then it is impossible that she will exist in 2012, given the minimal A-theory. So Lisa Obama determinately exists (albeit minimally) in 2011. But imagine 2012 comes and goes and the Obamas decide that Sasha and Malia are enough. If this possibility is realized, then Lisa Obama always was, is, and will be a merely possible girl. So open-future minimal A-theorists need mere possibilia corresponding to the objects on any unrealized branches that they countenance. Open-future minimal A-theorists must be more permissive than their determinist counterparts. All this shows is what we’d expect: our ontological commitments get messy depending on what assumptions about temporal structure we add to our A-theory. Don’t like mere possibilia? Abandon the open future. And mere possibilia aren’t obviously worse than the possible branches open future A-theorists already endorse.

One issue, admittedly, becomes very easy for all minimal A-theorists. There is no perfectly general, metaphysically interesting issue of persistence. There is no point in continuing to search for perfectly general persistence conditions for objects. Any object that ever exists is guaranteed to persist, given permanentism. For some, this might seem like grounds for criticizing the minimal A-theory. To me, it seems more of a surprising but welcome conclusion. We’ve had a terribly difficult time specifying persistence conditions for objects. These difficulties have lead some to a
kind of identity mysticism—the view that there simply are no informative criteria for
diachronic identity. But if the minimal A-theory is right, there is no deep mystery to
persistence as such. All along we should have been restricting our attention to issues
surrounding property supervenience or framing persistence debates as epistemological
puzzles. The really hard questions are rather whether a ship can gradually lose its
proper parts while continuously instantiating the property is a ship. And though we
may see a ship before us, we might legitimately be confused as to whether it is the
same ship that sailed centuries ago or whether it is a different one. Finding principled
answers to these more restricted questions of persistence is challenge enough for A-
theorists.

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41For example, Lowe and Merricks think that objects come into and out of existence, but it is a
primitive matter when they begin and when they end. See Merricks 1998 and Lowe 1996, 41-43.
Chapter 4
An A-Theory Without Tense Logic

A-theorists think there is a deep metaphysical difference between the present and other times. This concern shows up in what objects they take to exist, what properties they take to be fundamental, and how they formalize their views. As far as I can tell, nearly every contemporary A-theorist assumes that her metaphysics requires a tense logic—a logic with operators like $\mathcal{P}$ (“it was the case that...”) or $\mathcal{F}$ (“it will be the case that”). In this paper, I will show that there is at least one A-theory that does not require a logic with tense operators. It remains to be seen whether this A-theory is more plausible than more traditional formulations like presentism and growing block. I approach it more as a logical engineering problem. Tense operators and their attendant complications have long been an albatross for A-theorists. It is nice to see we have alternatives.

Section 4.1 describes the basic commitments of any A-theory and contrasts it with the two most common formulations of the B-theory. Section 4.2 considers three arguments that A-theories require tense operators and discusses some of the costs of having a tense logic rather than a predicate logic with quantification over times. Section 4.3 develops a theory of tense copulae (“was” and “will”) as predicate modifiers and a corresponding version of predicate logic. Section 4.4 introduces the Tense-Operator-Free A-Theory and shows that its central metaphysical commitments can be expressed in the logic with predicate modifiers. Section 4.5 suggests some ways the proposal might be expanded to accommodate more traditional A-theories. I relegate some technical details to two short appendices.
4.1 Three Accounts of Property Change

As I write this, Barack Obama is President. He won’t always be President. The Obama administration is temporary. For some, this fact induces anxiety. For others, it comes as a great relief. But only the most downtrodden Republican, the most pie-in-the-sky Democrat, or the most inflexible nominalist would deny that being President is some kind of temporary property of Obama. Generalizing, almost all of us believe in:

**Property Change:** There is at least one object, \( x \), and at least one property, \( C \), such that \( x \) is \( C \) only temporarily.

Philosophers nevertheless disagree over how this commonplace is to be expressed most precisely and what the view entails about objects, properties and the structure of spacetime. A-theorists think that temporary properties are properties that a single object can have or lack *simpliciter*. They think many genuinely temporary properties (the kind susceptible to property change) are best expressed by predicates without “time-slots”. According to some A-theorists, Obama changes because (i) Obama has the non-time-relational property *is President*, (ii) he endures for some time, and (iii) he (the very same, numerically identical object) will lack that property. Most A-theorists endorse:

**A-Property Change:** There is at least one enduring object (possibly a region of spacetime), \( x \), and at least one non-time-relational property, \( C \), such that \( x \) is \( C \) only temporarily.\(^1\)

\(^1\)Some A-theorists might agree to this but refuse to recognize it as the core of their view. We often hear other slogans used to characterize the A-theory/B-theory debate. A-theorists “take tensed facts seriously”, “respect the flow of time” or think there is “irreducible tensed structure.” I confess, I find these ways of characterizing the debate often obscure. For example, I take it facts are states of affairs out in the world, while tense is a limited feature of language. Endorsing “tensed” facts is endorsing
Examples of A-theorists include Prior, Zimmerman, Crisp, Markosian, Merricks, Broad, Adams, Forrest and Williamson.\textsuperscript{2}

B-theorists deny A-property change, usually in one of two ways. \textit{Relational} B-theorists think enduring objects undergo property change but insist that all temporary properties are relations between objects and regions of spacetime. They understand property change as:

\textbf{Relational Change}: There is at least one enduring object, $x$, at least two times, $t_1$ and $t_2$, and at least one relation, $R$, such that $x$ is $R$ at $t_1$ and it is not the case that $x$ is $R$ at $t_2$.

Examples of relational B-theorists include Thomson, van Inwagen, Gibson and Pooley.\textsuperscript{3} In contrast, \textit{temporal parts} B-theorists (also called “four-dimensionalists”) deny that genuine change requires time-relational properties but insist that objects change only if they have numerically distinct temporal parts that vary with respect to the property. They understand property change as:

\textbf{Temporal Part Change}: There is at least one object, $x$, that has at least two temporal parts, $p_1$ and $p_2$, and there is at least one non-time-relational property, $C$, such that $p_1$ is $C$ and it is not the case that $p_2$ is $C$.

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\textsuperscript{3}Thomson (1983), van Inwagen (1990), and Gibson and Pooley (2006). Gibson and Pooley give a relativistic gloss on what it is for an object to have a time-relational property. There are also some “exdurantist” B-theorists who explain property change as enduring objects having (tenselessly) certain non-time-relational properties and bearing something akin to counterpart relations to objects at other times. I will not consider this variant here. See Hawley (2006).
Examples of temporal parts B-theorists include Russell, Quine, Lewis, Price, and Sider.⁴

Each view carries metaphysical commitments about the structure of changing properties and the objects that instantiate them. For example, if the relational B-theorists are right, many properties have hidden structure. Nobody “just is” President; someone is only President at a time. If the temporal parts theorists are right, property change entails that objects have multiple temporal parts, because the immediate bearers of changing properties must be numerically distinct objects. Some philosophers doubt these metaphysical differences run very deep, but for the purposes of this essay, I will assume that the endurantism/temporal parts and relational/non-relational debates are substantive.⁵

Many inside the debate also think that A-theorists and B-theorists have different logical commitments. Say we wanted to write out the different precisifications of property change in a dialect of logic-ese. And say we wanted the logical representation of our theory to provide a somewhat accurate guide to our ontological and ideological commitments. Both kinds of B-theorist would only need the resources of a predicate logic. Relational B-theorists would express their view as:

 Relational Change 1: $\exists x \exists t_1 \exists t_2 \exists R(R(x, t_1) \land \neg R(x, t_2))$.⁶

Temporal parts theorists will make use of a precise kind of parthood relations. Here’s one way to formulate the temporal parts view. Let $PART(x, y)$ abbreviate the regionally-maximal parthood relation: $x$ is a regionally maximal part of $y$ if and

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⁴Russell (1915), Quine (1950), Lewis (1986), Price (1996), and Sider (2001). I include stage theorists in this camp, reading “temporal parts” to include temporal counterparts.

⁵For the opposing deflationist view, see Hirsch (2009) and Hofweber (2009b).

⁶If you are uncomfortable with explicit second-order quantification, we can also express this as: For some $R$, $\exists x \exists t_1 \exists t_2 (R(x, t_1) \land \neg R(x, t_2))$. Then apply whatever nominalist translation method you have to the English preamble. And a similar paraphrase could be applied to all of the logical formulations to come.
only if for some arbitrary “slice” of the spacetime manifold, if \( y \) has parts located at the slice, then every part of \( y \) at that slice is also a part (proper or improper) of \( x \). The view can then be stated in predicate logic as:

**Temporal Part Change 1:** \( \exists x \exists p_1 \exists p_2 \exists C (\text{PART}(p_1, x) \land \text{PART}(p_2, x) \land C(p_1) \land \neg C(p_2)) \)

In English: Some object has regionally maximal parts and one part instantiates a non-time-relational property, \( C \), while the other does not. As with the relational theory, the logic is purely extensional.

In contrast to the B-theorists, the vast majority of A-theorists will suspect that they need a logic with intensional operators to capture their view. They’ll adopt a quantified tense logic—a logic with the Priorian operators:

- \( \mathcal{P} \): “it was the case that”; and
- \( \mathcal{F} \): “it will be the case that”

These operators behave like the \( \Box \) of modal logic; they shift formulas to be evaluated at other “times”. In a quantified tense logic, A-Property Change is expressed as:

**A-Property Change 1:** \( \exists x \exists C (Cx \land (\mathcal{P} \neg Cx \lor \mathcal{F} \neg Cx)) \).

In English: there is some object and some property such that the object has the property, and either it was the case that the object lacks the property or it will be the case that the object lacks the property.\(^7\) This added commitment to tense logic is widely assumed to be part and parcel of adopting an A-theoretic metaphysics.

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\(^7\)Throughout, I will understand an object \( x \)’s lacking a property \( C \) just as it’s being false that \( x \) is \( C \). \( x \) lacks \( C \) iff \( \neg C(x) \).
dogma goes back at least to the early days of presentism. Hence Prior in *Past, Present and Future*: “The formation rules of the calculus of tenses are not only a prelude to deduction but a stop to metaphysical superstition.” And elsewhere: “Tense logic is for me, if I may use the phrase, *metaphysically fundamental*, and not just an artificially torn-off fragment of the first-order theory of the earlier-later relation.”

More recently, the link between the A-theories and tense logic has come into question. Zimmerman argues persuasively that a commitment to irreducibly tensed propositions in one’s metaphysics is not *sufficient* for an A-theory of time. Some B-theorists may want a tense logic for expressing their views of propositional content. Could we go the other way? Is tense logic even *necessary* for every A-theory? Is there any way to express the A-property change principle without tense operators? To get some traction on this question, we must consider arguments that the most plausible formulations of A-theories entail the indispensability of tense operators. There are at least three arguments suggested in the literature, and they depend on some problematic background assumptions. Consider each in turn.

### 4.2 Do A-Theories *Require* Tense Logic?

**The Argument from Expressive Adequacy**

The first argument for tense logic requires the fewest assumptions but will serve as the touchstone for most of this essay. In Section 4.1, I assumed you must endorse A-property change to count as an A-theorist. Many A-theorists will want to express

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8Prior (1967, 19).

9Prior and Fine (1977, 32). Emphasis is his.

their central metaphysical claim in a logically rigorous language. As we saw, if the A-theorist adopts some second-order version of a Priorian tense logic, this is easy enough to do as A-PROPERTY CHANGE 1. At least initially, it does not seem possible to express that an object has a temporary, non-time-relational property in any kind of standard predicate logic. For suppose an A-theorist tried to work without tense operators. She could either choose to use time-indexed predicates or not. If she doesn’t use time-indexed predicates, it seems she’ll be forced to say that an object has contradictory properties:

A-PROPERTY CHANGE 2: $\exists x \exists C(C(x) \land \neg C(x))$.

She can avoid this by assuming that the changing property $C$ is a time-indexed relation and expressing the thesis as:

A-PROPERTY CHANGE 3: $\exists x \exists t_1 \exists t_2 \exists C(C(x, t_1) \land \neg C(x, t_2))$.

But then her view collapses into the relational B-theory, and the A-theory is no longer an interesting metaphysical thesis. Here, then, is the argument from expressive power. A-theorists can either choose some tense logic as the background for their metaphysics or they can choose some version of predicate logic. If they choose tense logic, they can express their primary metaphysical commitment in a consistent, interesting, and prima facie plausible way. If they choose predicate logic, they cannot. Therefore, A-theorists are committed to tense logic. The problematic assumption, as we’ll see, concerns the expressive limitations of a predicate logic.

$^{11}$Zimmerman offers something like this argument in response to Lewis’s charges that only a four-dimensionalist theory can consistently accommodate changing, non-time-relational properties. See Zimmerman (1998). He is responding on behalf of presentist A-theories to Lewis’s “problem of temporary intrinsics.” See Lewis (1986, 202-204). For Lewis’s reply (which is targeted specifically to presentism), see Lewis (2002, 2).
The Argument from Temporalism

A second, related argument motivates the link between A-theories and tense logic by way of propositions. Many A-theorists are serious about propositions—they believe propositions have truth-conditions and serve as the objects of belief and assertion. Friends of propositions think that true propositions accurately represent the actual world. False propositions do not. Given the A-theory of property change, states of affairs change. Returning to our example, *is President* is a temporary property of Obama. If Obama has this property, then it seems the most accurate way to represent the state of affairs is a proposition like \([Pres(o)]\). Call this the *Obama proposition*. As I write this sentence, the Obama proposition is true. Given that *is President* is a temporary property, the Obama proposition is only temporarily true. The Obama proposition does not always accurately reflect the actual world. How do we express this feature of the proposition? It seems we can either build a time-index into the proposition or we can append some tense operator to the proposition. If we take the former option, we’d think sentences like “It is temporary that Obama is President” really express the same proposition as “Obama is President at 2009 and there is some time when it is not the case that he is President.” (In logic-ese: \([Pres(o, 2009) \land \exists t \neg Pres(o, t)]\).) But then the Obama proposition does *not* accurately represent the actual world, because according to the A-theorists, *is President* is *not* time-relational. So it must be that we express the temporariness of the Obama proposition using a tense operator, i.e. \([Pres(o) \land F\neg Pres(o)]\). Therefore, A-PROPERTY CHANGE and seriousness about propositions entail a commitment to tense logic. Call this the *argument from propositional temporalism*. The problematic assumption, as we’ll see, is that only tense operators can capture temporary truth.
The Argument from Ontological Change

The last argument for tense logic is the most common and also has the most background assumptions. The vast majority of metaphysicians nowadays (A-theorists included) are neo-Quineans. Neo-Quineans endorse a package of views about existence:

1. There is a single sense of “exists” of interest to metaphysics.
2. Existence is not a property of objects.
3. Existence is properly denoted by quantifiers (in particular $\exists x$), not by a first-order existence predicate like $E!$.
4. If we take a sentence as true and that sentence is headed with an existential quantifier, then we must hold that everything in the domain of the quantifier exists, in the metaphysically important sense of “exists.”
5. Ontological commitment can be blocked if the quantifier is in the scope of a prophylactic operator like “it is possible that,” “it is true in a fiction that,” or—more controversially—“it was the case that,” or “it will be the case that.” For example, the sentence “In the Battlestar fiction, there are five unidentified Cylon models” need not entail the existence of Cylons. But unprotected quantification—“There are five unidentified Cylon models”—does.¹²

Neo-Quineanism is a popular view and with good reason. It nicely summarizes widely-held convictions about how we should reason about existence. And it provides adherents some defense against charges that their metaphysical debates are non-substantive. When deflationists complain that A-theorists and B-theorists equivocate between senses of “exists” in their debates over temporal parts and past or future objects, neo-Quineans can straightforwardly deny the charges. And they can appeal

¹²Quine exegesis is tricky, but van Inwagen makes a persuasive case that doctrines like these can be linked to the original Quine. I do not care so much about the historical claim here; as a matter of current philosophical sociology, many metaphysicians endorse these principles. For some examples of neo-Quineanism in the A-theory/B-theory debate: see Zimmerman (1998, 210), Crisp (2004, 16-17), and Sider (2001, 17).
to the different logical forms of their theories (in particular the quantificational structure) to defend substantivity.

Neo-Quineanism coupled with a further view about change entails the indispensability of tense logic. The most common A-theories by far are presentism and growing block. Call these the traditional A-theories. Traditional A-theorists supplement A-PROPERTY CHANGE with an extra assumption:

TEMPORARY EXISTENCE: Some objects only exist temporarily.

(Notice, this must be an extra assumption because, as neo-Quineans, they do not think existence is a property that objects gain and lose.) Presentists think objects come into existence and go out of existence. The only objects that exist are present objects. Growing blockers think objects come into existence but never cease to exist. Objects come into existence, but once something exists, it is forever “stuck” in an expanding spacetime manifold. Both think that there are truths expressed by claims like “There was a dinosaur” or “There will be a Mars outpost” But neither think future Mars outposts exist (in the metaphysically important sense of “exist”), and presentists further deny there are any dinosaurs. Call such merely past or merely future objects temporal aliens.

To handle what seem to be true existential claims about temporal aliens in the

\[13\]There are somewhat less-traditional A-theories that also sign on for versions of temporary existence. For example, Camp 3—which, as far as I can tell, has only one member—is the falling branch view advocated by McCall (1994). According to McCall, change over time is best explained as the deletion of certain merely future branches of time. In a sense, all ontological change is negative ontological change—objects passing out of existence.


\[15\]Traditional growing block views include Broad (1923), Adams (1989), and Forrest (2006). Many growing blockers are perdurantists about ordinary objects, but they think the “growing edge” of the block—the distinguished spacetime region—changes in accord with A-PROPERTY CHANGE.
neo-Quinean framework, traditional A-theorists turn the resources of tense logic. According to traditional A-theorists, certain tense operators—namely $\mathcal{F}$ and $\mathcal{P}$—have the prophylactic effect on quantifiers in their scope. Claims like “It will be the case that there are interplanetary outposts.” are to be understood as no more ontologically loaded than “According to the Battlestar Galactica fiction, there are interplanetary outposts.” So—the strategy goes—truths about temporal aliens should always be expressed using prophylactic tense operators. If now-childless Ruth and Jake will have a child, a de dicto claim of the form $\mathcal{F}\exists x C(x, j, r)$ is true; in English: “It will be the case that something is the child of Jake and Ruth.” But presentists and growing blockers will deny that this entails any de re claim: $\exists x \mathcal{F}C(x, j, r)$ and so deny that their future child exists. The wide-scope prophylactic $\mathcal{F}$ blocks unwanted children, and there is no other explicit mechanism in neo-Quineanism for doing this. So given temporary objects, neo-Quineanism, and truths about temporal aliens, traditional A-theorists conclude that tense logic is indispensible. Call this the argument from ontological change, because the crucial assumptions are about objects which change with respect to existence. The problematic assumption, as we’ll see, is that prophylactic tense operators can help traditional A-theorists capture truths about temporal aliens.

**But Tense Logic Has Baggage**

If the three foregoing arguments succeed, some tense logic is a necessary feature of plausible A-theories. This is not a universally welcome result. Some philosophers, following Quine, just have a strong allergy to intensional logics. For confirmed extensionalists, logics with tense or modal operators are objectionably *ad hoc*—the operators are “special-purpose” add-ons that complicate predicate logic significantly
without broad systemic benefits.\textsuperscript{16} Given the extraordinary work that has been done to develop intensional logics and the uses they have been put to in epistemology, metaphysics, and philosophy of language, this objection seems little more than a matter of taste, and it shouldn’t overly concern A-theorists. A nearby concern might be more urgent. Some metaphysicians nowadays (especially neo-Quineans) hope that their logical primitives will all reflect their views about the structure of reality.\textsuperscript{17}

The A-theories are often mysteriously described as theories that think tense operators fundamentally “carve reality at its joints” or represent “fundamental structure.” But what is it for an \textit{operator} to reflect reality? Wouldn’t it be better if, like the B-theories, every logical device required by the A-theory easily mapped to more familiar categories like objects and properties?

And even setting aside the mystery of primitive operators, there are two more pressing difficulties for the usual A-theoretic approaches to tense. First, the relationship between tense logic and reasoning in natural languages is not at all clear. Kamp, Partee, Enc, King and many others make persuasive cases that English tenses are best modeled as some kind of quantification over times.\textsuperscript{18} Simple Priorian tense logic (tense logic without many metrical operators) delivers overly permissive readings of some English sentences. For one example, say John got into a car accident on Monday. You ask me what John was up to when the accident happened, and I reply, “John was driving to the bar.” In Priorian tense logic we’d most straightforwardly symbolize my assertion as \(\mathcal{P}D(j, b)\). In English: “It was the case that John drives to the bar.” But this is true just in case John drives to the bar at some time or other. Say I really just want to impugn John’s character—he drives to the bar some weekends but on this particular Monday, I know he was driving to work. On the most natural reading, my

\textsuperscript{16}For example see Lewis (1968, 113).

\textsuperscript{17}For example, Sider (Forthcoming).

\textsuperscript{18}See Kamp (1968), Partee (1973), Enc (1986), and King (2007).
assertion ought to be false—it ought to be restricted to the time when the accident happened. But on the simple Priorian regimentation, my gossip will count as true so long as John drove to the bar some day or other.

Priorian tense logic is also sometimes too restrictive. Imagine the Chair of the department describes its admissions policy as follows: “All matriculated Philosophy graduate students were undergraduate Philosophy majors.” On one of its natural readings, the policy applies not only to current graduate students but also future and past graduate students. We have two options for symbolizing the sentence using a single tense operator. First, we might give the operator wide scope: \( \mathcal{P}(\forall x G(x) \rightarrow U(x)) \). But then the sentence would be false, because there is never a time when a graduate student is an undergraduate. What if we give the tense operator narrow scope, as in \( \forall x (G(x) \rightarrow \mathcal{P}U(x)) \)? Then the sentence can be true, but it is restricted to current graduate students. To get the permissive truth conditions for the English sentence, we’ll have to resort to multiple embedded tense operators. But, as has been widely noted by linguists, embedded operators raise a new set of bad predictions for English tenses.

Considerations from natural language semantics do not rule out Priorian tense logic as the appropriate formal backdrop for reasoning about the metaphysics of time, but they show that tense logic lacks the expressive resources to straightforwardly capture some intuitively valid inferences about time—namely any inferences that depend on the unavailable readings. All else equal, we should prefer logics that can do “double duty,” formalizing our metaphysical commitments accurately and explaining patterns in our ordinary thought and speech. A-theorists who rely on tense logic seem to run afoul of this desideratum in a way that B-theorists who quantify over times do not.\(^1\)

\(^1\)Related to this, Richard argues that propositional temporalists cannot account for our intuitions about seemingly invalid arguments like:

(1) Mary believed that Bush was President.
Second, and more pressing for metaphysicians, it is not clear that tense logic can block unwanted ontological commitments. The traditional A-theorists (which constitute most A-theorists) think objects change with respect to existence and that claims about temporal aliens are ontologically innocent so long as they are in the scope of a \( \mathcal{P} \) or \( \mathcal{F} \). But there is a problem for this “prophylactic operator strategy.” Even the weakest tense logics combined with classical quantification theory have the converse Barcan schemas as theorems:

\[
[C\mathcal{B}\mathcal{P}] \exists x \mathcal{P} \alpha \rightarrow \mathcal{P} \exists x \alpha; \text{ and } \\
[C\mathcal{B}\mathcal{F}] \exists x \mathcal{F} \alpha \rightarrow \mathcal{F} \exists x \alpha.
\]

Initially, these schemas seem relatively benign. They simply imply that true de re claims entail true de dicto claims. For example, “Something was a dinosaur” entails “It was the case that something is a dinosaur.” For traditional A-theorists, only the reverse de dicto-to-de re entailment would be directly problematic. The prophylactic operator strategy won’t work if “It was the case that there is a dinosaur” entails “There is something that was a dinosaur.” But we’d need a stronger tense logic to get this entailment, and as we strengthen the tense logic, it is less obvious that we are representing the real structure of spacetime.\(^{20}\)

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(2) Mary still believes everything she ever believed.

(C) Mary believes that Bush is President.

Given propositional temporalism, this argument should strike us as valid. Let \( \alpha \) be the proposition “Bush is President.” Temporalists think the Mary Argument has this form:

(1') \( \mathcal{P}B(m, \alpha) \)

(2') \( \forall x \mathcal{P}B(m, x) \rightarrow B(m, x) \)

(\text{C'}) \( B(m, \alpha) \)

See Richard (1981). I think temporalists should concede the argument is valid but deny that (2') is the appropriate way to capture belief retention (at least in rational agents). See Chapter 5.

\(^{20}\)The regular Barcan schemas are

\[
[BP] \exists x \mathcal{P} \alpha \rightarrow \exists x \mathcal{P} \alpha; \text{ and } \\
[BF] \mathcal{F} \exists x \alpha \rightarrow \exists x \mathcal{F} \alpha.
\]

We can derive the regular tensed Barcan schemas in tense logics that parallel S5 and Brouwer modal logic. I discuss some issues with these elsewhere. See Chapter 2.
Nevertheless, the converse Barcan schemas run roughshod over traditional A-theorists’ assumption that there are some temporary objects. For example, the traditional A-theorists think Obama hasn’t always existed. So there is at least one object such that once, it did not exist. As good neo-Quineans, they express temporary existence using existential quantifiers, tense operators and identity (not an existence predicate):

\[ (1): \exists x \mathcal{P} \forall y \neg (x = y). \]

But (1) and \([CBP]\) entail:

\[ (2) \; \mathcal{P} \exists x \forall y \neg (x = y). \]

(2) holds that it was the case that something is nothing. This result is absurd. Necessarily everything is something. Far from being a self-esteem mantra for objects, this is a logical truth in standard quantified modal logics. A fortiori, there has never been a time when something is nothing. Claims asserting temporary existence yield a contradiction in standard quantified tense logics. So a commitment to any standard quantified tense logic will not uphold neo-Quineanism, ontological change, and truths about temporal aliens. Choosing a logic for temporary existence is no easy matter. And if the prophylactic operator strategy fails, it is far less obvious that tense logic is earning its metaphysical keep.

A-theorists have options in responding to these problems with tense operators. Some might reluctantly admit that their logic cannot explain some seemingly valid inferences. Others might radically inflate Priorian tense logic with metrical operators. Others undertake heroic efforts to assimilate tense operators to natural language semantics.\(^{21}\) Some are driven to devise ever-more-complicated quantified tense logics to

\(^{21}\)In particular, Ludlow explains the anaphoric behavior of tense using a device he calls “E-type
explain ontological change.\textsuperscript{22} Still others adopt an abstinence policy: they deny there are any temporary objects.\textsuperscript{23} But the problems might lead us to question whether A-theorists need even bother with tense operators. None of the indispensability arguments are ironclad. So here’s the proposed engineering project. Can we build a theory of time (a logic and a corresponding metaphysics) that upholds A-property change without making use of tense operators? In the next two sections, I will show that we can. First I will devise a version of predicate logic with a novel tool for expressing tense. Then I will use this logic to state an interpretation of A-property change. I call the resulting logic and metaphysics the \textit{Tense-Operator-Free A-Theory}.

4.3 \textbf{STEP 1: Tense as a Predicate Modifier}

The first step in devising the new A-theory requires us to expand the language of predicate logic. This section will provide an overview of the new logic and some independent motivations for it. In Appendix 1, I outline the system more explicitly. We start with standard predicate logic or (SPL). (SPL) contains a set of terms (constants and first-order variables) \(\{a_1 \ldots a_n, x_1 \ldots x_n\}\), a set of predicates and second-order variables each with an arity, \(n\), \(\{G^n, H^n \ldots\}\), truth-functional operators (\(\neg, \rightarrow\)), and quantifiers (\(\forall, \exists\)). The grammar for (SPL) is familiar: the simplest well-formed formulae in (SPL) result from a predicate with \(n\) argument places being satisfied by \(n\) terms; \(\neg\) or any quantifier joined with a wff yields a wff; any two wffs joined with \(\rightarrow\) yields a wff, and so on.

\textsuperscript{22}For example, Prior’s System Q: see Prior (1967).

\textsuperscript{23}Williamson (1998).
We are going to add a new component to this language, a **predicate modifier**.\(^{24}\) We’ll symbolize predicate modifiers using capital letters with a superscript and a subscript: \(\{M^n_m, L^n_m \ldots\}\). Semantically, predicate modifiers join with predicates to yield more complex predicates of the same order. The superscript, \(n\), indicates the arity of predicates that the modifier can modify. Call this the modifier’s *degree*. The subscript, \(m\), indicates the arity of the complex predicate that the modifier returns. Many common predicate modifiers are *simple*: they always return a predicate of the same arity of the one they modify. For example, the English modifier “slowly” takes intransitive verb predicates like “runs” and results complex, one-place predicates like “slowly runs”. Other predicate modifiers are *expanders*: they return a predicate with a higher arity than the predicate they modify. The most common examples of these in English are prepositions like “in”. The modifier “in” takes a one-place predicate like “runs” and returns a relation of the form “runs in (...).”\(^{25}\)

With the new additions to the language of (SPL), we add two formation rules. First, for any simple predicate modifier \(M^n_n\) and any wff, \(\alpha\), of the form \(G^n(a_1 \ldots a_n)\), \(M^n_n\alpha\) is a wff. Second, for any expander \(M^{n+i}_{n+i}\) and any wff, \(\alpha\), of the form \(G^n(a_1 \ldots a_n)\), \(M^{n+i}_{n+i}[\alpha](a_1, \ldots, a_i)\) is a wff. In (SPL) with modifiers, we can express “John runs slowly” as \(S^1_1 R^1(j)\). We can express “John yells in the car” as \(I^1_1[Y^1(j)](c)\). We can express “John yells somewhere” as \(\exists x I^1_1[Y^1(j)](x)\).

Why include predicate modifiers in our logic? Parsons, Clark and others think that they play a useful role in formalizing English expressions involving adverbs and


\(^{25}\)Along these lines, we might wonder whether there are any predicate *reducers*. Perhaps constant terms can be reinterpreted as predicate reducers of the form \(C^n_{n-1}\). When such a modifier combines with a predicate, it yields a new predicate with one fewer argument place. On this approach, we might define an atomic sentence as any complex predicate with arity 0. It’s a thought at least, but I won’t bother with a theory of reducers here. (This proposal has a certain affinity with Quine’s program for eliminating variables with “derelativizing” operators. See Quine (1960a).)
prepositional phrases. Other approaches to modeling adverbs and prepositions in predicate logic are far more awkward and deliver unacceptable entailments. Reichenbach developed one of the first theories of adverbs and prepositions in predicate logic, and his treatment serves as the inspiration for Davidson’s now-prominent event theory of adverbs.\(^\text{26}\) I’ll briefly survey both and their problems, starting with Reichenbach. In his system, “John runs” expresses the same proposition as “There is a property John has and it is a running property.” Let \(\mu\) be the second-order predicate for \textit{is a running property}. In (SPL), Reichenbach formulates “John runs” as: \(\exists G(G(j) \land \mu(G))\). Adverbs and prepositions are then added as additional second-order predications. Let \(\sigma\) denote a second-order predicate for \textit{is a slowly property}; in Reichenbach’s system, “John runs slowly” is \(\exists G(G(j) \land \mu(G) \land \sigma(G))\). Let \(\varrho\) be a second-order relation for \textit{is a property had in...} “John runs in Mexico” is \(\exists G(G(j, m) \land \mu(G) \land \varrho(G, m))\). Unlike the predicate modification approach, Reichenbach’s system seems to imply too much. When I assert “John runs,” am I asserting the existence of at least one property? The approach seems needlessly hostile to nominalism. (Of course, so are the formulations of change given in Section 4.1, but that is another matter.) Davidson’s system doesn’t fare much better. He insists that adverbs are predicates of events, formulating “John runs slowly” as \(\exists x(R(j, x) \land S(x))\) In English, “There is an event of John running and it is slow.” The Davidsonian semantics requires a quantification over events that more desert-landscape neo-Quineans should find distasteful. As Clark colorfully puts it, “the overriding, pointed, difficulty (in the system)... lies in Davidson’s rain-forest ontology.”\(^\text{27}\)

But far worse than the extraneous ontology, neither system can handle non-standard predicate modifiers. Consider sentences like “John is an apparent heir.” or “John is apparently drinking.” “Apparent” and “apparently” seem to function as

\(^{26}\)Reichenbach (1947) and Davidson (1980).

\(^{27}\)Clark (1974, 32).
predicate modifiers in both cases. Reichenbach’s system formulates the first sentence as \( \exists G(G(j) \land \mu(G) \land \sigma(G)) \), where \( \mu \) is a second-order predicate for \textit{is an heir property} and \( \sigma \) is a second-order predicate for \textit{is an apparent property}. Davidson formulates the second sentence as \( \exists x(D(j, x) \land A(x)) \). Back in English, “There is an event that is an event of John drinking and it is an apparent event”. The first conjunct in the Davidsonian translation entails that John is drinking (or there is an event of John drinking). But apparently drinking \textit{doesn’t} entail that one is drinking. Likewise, the first and second conjuncts of the Reichenbach translation entail that John is an heir. But apparent heirs \textit{aren’t} heirs. So the systems deliver false entailments. A similar problem arises for sentences like “Dean is a famous metaphysician.” The Reichenbach translation entails that Dean is famous. But intuitively (and much to the chagrin of many a philosopher at a cocktail party...) being a famous metaphysician does \textit{not} entail that one is famous. (SPL) with predicate modifiers does not have these problems because it treats all predicate modifier phrases as denoting distinct first-order properties. Thus, there is some reason to think predicate modifiers are necessary for a uniform treatment of adverbs and prepositions in English.\(^{28}\)

Besides its linguistic advantages, (SPL) with predicate modifiers also opens some new options for describing change over time.\(^{29}\) In Section 4.2, I discussed some philosophers who doubt natural language tense is adequately captured with primitive operators. What if, instead, we think of tense copulae like “was” and “will” as predicate modifiers? Here is the proposal. Let \( P_m^n \) be the predicate modifier “was” and \( F_m^n \) be the predicate modifier “will”. These modifiers act on a stock of tenseless or present-tensed predicates (like “is running” or “is President”) to yield past or future-tensed

\(^{28}\)Parsons later offers a much more detailed theory of modifiers and their role in Davidsonian semantic theories. See Parsons (1990, 40-67.) His mature view is that a uniform treatment of modifiers is not possible.

\(^{29}\)Clark recognizes this application to tense and modality in Clark (1974), but he never develops the corresponding theories.
predicates (“was running” or “was President”). As before, we have options for typing the tense copulae:

Option 1: “was” and “will” are simple modifiers just like “slowly”—they have the same arity of the predicate they modify.

Suppose John was running. If $P^n_m$ is a simple modifier, we represent this as: $P^1_1R^1(j)$. Or:

Option 2: “was” and “will” expand the arity of the predicate they modify by one argument place—a time slot.

If $P^n_m$ is a one-place expander, we symbolize “John was running” as $\exists tP^1_2[R^1(j)](t)$. In this case, we assume the sentence “John was running” elides a prepositional phrase; it expresses the same proposition as “There is some time such that John was running at that time.” Many traditional A-theorists who endorse ontological change will immediately balk at Option 2, because of this quantification over other times. The vast majority of presentists deny there are any merely past or future times, and growing blockers reject future times. Let’s bracket these worries for the moment, because, as we’ll see in Section 4.5, there are more general problems for accommodating the traditional A-theories in this logic.

Options 1 and 2 are not exclusive, though if we make certain additional metaphysical or semantic assumptions, there are cases where we might strongly prefer one over the other. For example, Option 1 is somewhat awkward when we want to describe cyclical change. To see why, assume \textit{being z-spin up} is a temporary monadic property ($Z^1(x)$). I take an electron, $a$, and run it through an experiment where I

\footnote{Note that I’m not respecting the tense/aspect distinction here—the difference between “runs”/“is running” and “ran”/“was running.” I leave formalizing these distinctions to the linguists.}
keep switching its spin. At the start of the experiment, \(a\) is z-spin up, then it isn’t, then it is. In English, we describe the experiment with a sentence like the following: “\(a\) is z-spin up, it was once not z-spin up, and it was once z-spin up.” How do we formulate this in (SPL) with predicate modifiers? Here’s how we’d initially do it with Option 1: \(Z^1(a) \land \neg P_1^1 Z^1(a) \land P_1^1 P_1^1 Z^1(a)\). Problem: the second and third conjuncts contradict each other. Can we avoid this by stacking tense modifiers? Say we describe the experiment instead as \(Z^1(a) \land \neg P_1^1 Z^1(a) \land P_1^1 P_1^1 Z^1(a)\). Minor problem: these doubly modified predicates are grammatically unfortunate in English. Translating “\(P_1^1 P_1^1 Z^1(a)\)” back we get “\(a\) was was z-spin up.” Major problem: it seems the doubly modified predicates should reduce to just the singly modified predicates. If someone is an apparent, apparent heir, then they are an apparent heir. If something was, was red, then it was red. With Option 2 we avoid all these issues. We translate the sentence as \(Z^1(a) \land \exists t_1 \neg P_2^1[Z^1(a)](t) \land \exists t_2 P_2^1[Z^1(a)](t) \land (t_1 <, t_2)\). (Where “<” denotes the earlier than relation. There is an interesting question as to whether this should also be tensed, which I will address momentarily). In English: “\(a\) is z-spin up, at some time \(a\) lacks property was z-spin up then, and for some earlier time, \(a\) has the property of being z-spin up then.” No problems here. So to accommodate cyclical change, we will want some tense modifiers to be expanders.

Likewise, we’ll want the logic to be able to distinguish cases like “John was not drinking” and “John never drank.” With Option 1 alone, we could do this if we introduced new predicate modifiers for “never” and “always” and treat negation as a predicate modifier. Let \(A_1^1\) be the “always” modifier. We would formalize the sentences as \(\neg P_1^1 D^1(j)\) and \(P_1^1 A_1^1 N_1^1 D^1(j)\) respectively. In English, the second sentence reads “John was always a non-drinker.” But it is a bit more economical to draw the distinction using Option 2: \(\exists t [\neg[P_2^1 D^1(j)](t)\) and \(\forall t [\neg[P_2^1 D^1(j)](t)\). And Option 2 lets us straightforwardly capture the readings of the problematic tensed sentences in Section 4.2. Remember the problems formulating “John was driving to the bar” so
it reflects Monday as the salient time of evaluation? With Option 2, we can do this straightforwardly. Where “m” denotes Monday: \([P_1^1D(j)](m)\).

Still there are costs to \textit{exclusively} adopting Option 2, for even if we are open to quantifying over other times, we might want to retain Option 1 to describe the past and future properties of times themselves. Substantivalist A-theorists think that at least one region of spacetime exists and instantiates properties. Regions of spacetime surely undergo property change in accord with the A-property change principle. Imagine it is New Year’s Eve. Right after the ball drops, I assert, “2009 was a bad year.” The assertion is true when uttered. 2009 lost the property \textit{is bad} and gained the property \textit{was bad}. With Option 1, we express “2009 was bad” as \(P_1^1B^1(2009)\). With Option 2, we express it as \(\exists tP_2^1[B^1(2009)](t)\). Translating back to English, this second formulation seems awkward: “There is a time such that 2009 was bad \textit{then}.” It might be trivially true that 2009 was bad at 2009, but it’s certainly not elegant. So those sympathetic to the predicate modifier strategy should probably retain some simple tense modifiers to use just in describing the temporary properties of spacetime regions. In the remainder of my argument, I am going to set aside the interesting question of describing change in spacetime itself and just focus on the metaphysics we can conduct with one-place expander modifiers. But nothing I say will prohibit us taking Option 1 back, and I’ll put it to one metaphysical use in Appendix B.

I’ve specified the language and formation rules for (SPL) with predicate modifiers. We have, in effect, devised a predicate logic with primitive tense. The axioms, rules of inference and semantics for this logic are somewhat flexible, depending on one’s other metaphysical commitments. I will not further pursue the issue of whether a version of (SPL) with tensed predicate modifiers is adequate for capturing natural language tense. Instead, I want to turn to the primary metaphysical ambition for
tense modifiers. Expanded (SPL) is expressive enough to capture at least one A-theory—the Tense-Operator-Free A-Theory.

4.4 STEP 2: A-Theory Metaphysics without Tense Operators

Initially, the Tense-Operator-Free A-Theory assumes three principles:

(1) A-PROPERTY CHANGE: There is at least one enduring object, $x$, and at least one non-time-relational property, $C$, such that $x$ is $C$ only temporarily.

(2) CORE PROPERTIES AND PREDICATES: There is a set of core predicates that denote properties. These predicates are either tenseless or present-tensed. (It does not matter for present purposes.) At least some of these predicates do not have “time-slots”—argument places that are satisfied with times. And there is a set of predicate modifiers that join with other predicates to yield complex, first-order predicates. These complex predicates denote distinct, non-core properties.

(3) PAST AND FUTURE ANALOGUE PROPERTIES AND PREDICATES: “Was” and “will” are predicate modifiers. In normal circumstances (i.e. when we are not applying them to predicates of times), they function as one-place predicate expanders. There are past and future properties denoted by complex predicates formed with “was” and “will” joined with other predicates. We will call these past and future analogue properties.

These three principles are enough to show that the argument from expressive power is unsound, for we can formulate a coherent version of A-property change in standard predicate logic with predicate modifiers. Where $P_{n+1}^n$ and $F_{n+1}^n$ are tense predicate modifiers:

$$A-PROPERTY \ CHANGE \ 4: \ \exists x \exists C^n(C^n(x)) \wedge \exists t (\neg \exists P_{n+1}^n[C^n(x)](t) \vee \neg F_{n+1}^n[C^n(x)](t))$$
According to this version of the A-theory, something exhibits A-property change property only if it has a non-time-relational property, endures, and lacks a past or future analogue of that property. Obama’s administration is temporary because Obama is President, he endures, and for some time he lacks the future analogue property will be President at that time. The minimal A-theoretic commitments are both respected: (1) the change only involves a single enduring object—the object assigned to $x$—and (2) the temporary property, $C^n$, is non-time-relational. Only $C^n$’s past or future analogues are time relations. So some version of (SPL) does have the expressive resources to capture A-property change without contradiction or collapsing into the relational B-theory.

One might worry that the proposed interpretation does not adequately capture property change because it does not express change with respect to a single property, $C^n$; it only expresses that an object has or lacks two distinct properties—the temporary property and the past or future analogue. Call this the too many properties objection. The objection closely parallels one we might raise against the temporal parts B-theory. Recall the temporal parts formulation of property change:

\[
\begin{align*}
\text{Temporal Parts Change 1: } & \exists x \exists p_1 \exists p_2 \exists C(PART(p_1, x) \land PART(p_2, x) \land C(p_1) \land \neg C(p_2)).
\end{align*}
\]

According to the view, the object which changes does not directly instantiate the

---

31 I’m not the first philosopher to focus on the role that tensed copulae might play in a theory of time. Johnston has a theory where we understand tensed copulae as denoting an instantiation relation with three argument places. Sentences like “Obama was President” are to be understood as expressing the same proposition as “Obama has-at-2008 the (non-relational) property is President.” Haslanger (1989) develops a similar theory. For a critical discussion of these proposals see Lewis (2002). Lewis objects that their approach to tensed copulae places too much weight on the instantiation relation, inviting Bradley’s regress.

32 To further emphasize the differences between the Tense-Operator-Free A-Theory and the relational B-theory: (1) The Tense-Operator-Free A-Theory encodes the non-relational nature of our present temporary properties in the logic, and (2) with the Tense-Operator-Free A-Theory we can express change for regions of spacetime—relational B-theories cannot coherently express such change, nor would they want to.
changing properties: other objects—its temporal parts—stand-in as the instantiators. One might object that this description of change fails to capture our belief that a single object changes by gaining or losing properties. Call this the too many objects objection to temporal parts theories. On this broad issue, as the Tense-Operator-Free A-Theory goes, so it seems goes the temporal parts theory.

I don’t think we should take the too many properties or too many objects objections seriously, at least not without significant further argument. Every theory we’ve surveyed has a surprising entailment. If supporters of the Tense-Operator-Free A-Theory are right, having a property temporarily entails lacking at least one other analogue property. If the temporal parts camp is right, then having a temporary property entails having multiple temporal parts. If the relational B-theorists are right, change involves having or lacking relations to distinct regions of spacetime. If the regular A-theorists are right, having a property temporarily entails some fundamentally tensed fact. In evaluating these “extra” commitments, I agree with Sider: “What is certain is that things persist, somehow, that things change somehow, and that things have properties at times somehow. It is not part of reasonable common belief just how this occurs.” Any precise account of change will require some flexibility in our pre-philosophical notions. The Tense-Operator Free A-Theory is no better or worse than others in this respect. The controversial aspect of the proposed A-theory is its assumption that there are past or future analogue properties that objects can have or lack, and disputing this will require far more work. Further, supporters of the proposal have options for giving a theory of how the distinct properties are nonetheless importantly similar; they need only co-opt whatever explanation we might offer for why distinct properties like is an heir and is an apparent heir are nonetheless importantly similar.

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33 Haslanger calls this the “proper subject” objection and expresses some sympathy for it. See Haslanger (2003, 331-334).

4.5 Accommodating Temporalism and Ontological Change

A-theorists who only commit to A-property change do not need tense operators. But few A-theorists are minimalists. Many believe in propositional temporalism and ontological change. Can the Tense-Operator-Free A-Theory support these more robust A-theories? Here the verdict is mixed. There is a way to express propositional temporalism using just (SPL) with predicate modifiers, but it requires non-trivial truth predicates. And the proposal offers nothing to aid traditional neo-Quinean A-theorists in expressing temporary existence, though it can do the job if we admit an existence predicate. I’ll close by developing these options for extending the Tense-Operator-Free A-Theory.

As we saw in Section 4.2, some A-theorists think they require tense operators to describe how the truth-values of propositions change over time. They suppose the proposition that Obama is President is true but was once false and will be false again. Typically, propositional temporalists express this using tense operators. Where \( \alpha \) is any temporarily true proposition: \( \alpha \land (P\neg\alpha \lor F\neg\alpha) \). With further assumptions, we can accommodate a kind of propositional temporalism:

\[
(4) \text{TRUTH PROPERTY: At least one truth predicate, } T^1, \text{ denotes a property and occurs in the logic.}
\]

Assuming (4), we express the temporariness of certain propositions using tensed truth predicates:

**Propositional Temporalism:** \( \exists \alpha (T^1(\alpha) \land \exists t (\neg P^1_2[T^1(\alpha)(t)] \lor \neg F^1_2[T^1(\alpha)](t))) \).

On this construal, propositional temporalism is the view that there is some proposition which is true, and which either was not true at some time or will be not true
at some time. This version of the proposal requires not only a present or tenseless truth predicate (and corresponding property), but also past and future truth predicates (and corresponding properties.) Some A-theorists may welcome this alternative for expressing their temporalism, and with the truth predicates we can recover many of the inference patterns formalized in tense logic. (In Appendix B, I give some postulates for how temporary propositions depend on objects with temporary properties and vice versa.) But others will buck the strong truth property assumption. Presumably one could believe in propositions, endurantism, and temporary but non-time-relational properties but still think that truth predicates are extraneous or problematic. (This seems to be Prior’s mature view; I am not aware of any other A-theorists tempted by truth-predicate deflationism). Tense logics, in contrast, can be developed with or without an explicit truth predicate. Barring another way of characterizing propositional temporalism, the Tense-Operator-Free A-Theory is not an attractive option for some kinds of temporalist deflationist. But this isn’t so worrisome—the vast majority of temporalists characterize their view with reference to non-trivial truth predicates.

What about A-theorists who believe in ontological change? Can we express claims like “Something only temporarily exists” in the new logic? The system lacks any tense operators, so a fortiori it lacks prophylactic tense operators. But we can express claims about temporary existence if we assume:

(5) **Existence Property:** A first-order existence predicate, \( E^{1} \), denotes a property and occurs in the logic.

Assuming existence is a first-order property, we express temporary existence as:

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35Prior (1971).
Temporary Existence 1: \( \exists x (E!^1(x) \land \exists t (\neg P_2^1 [E!^1(x)](t) \lor \neg F_2^1 [E!^1(x)](t))) \)

On this construal, ontological change is the view that there is some object which exists, endures, and has either the property did not exist at some time or will not exist at some time. We express truths about merely past objects like Caesar as follows: \( P_2^1 E!^1 R(c) \). From this we cannot infer \( E!^1 R(c) \) any more than we can infer “John is an heir” from “John is an apparent heir.”

Trouble is, as already noted, many A-theorists (and B-theorists) are neo-Quinean, and neo-Quineans explicitly reject existence as a first-order property. Expressing temporary existence in the Tense-Operator-Free A-Theory thus requires a radical departure from the neo-Quinean program. For many of us, this is intolerable. So neo-Quinean A-theorists have a choice: abandon temporary existence or reject the Tense-Operator-Free A-Theory. I think there are already good metaphysical and logical reasons to abandon temporary existence, so I don’t find this result particularly troubling.\(^{36}\) And given the converse Barcan schemas, the proposal is no worse off than any standard quantified tense logics when it comes to upholding temporary existence. Still, the Tense-Operator-Free A-Theory is no friend to neo-Quinean versions of presentism and growing block.

4.6 Conclusions: Narrow and More Ambitious

At the very least, we see that tense logic is not automatically entailed by adopting an A-theory of time. The connection between the A-theories and tense logic arises from additional metaphysical assumptions. We might wonder further whether the Tense-Operator-Free A-Theory is just another animal in Russell’s “logical zoo” or

\(^{36}\)For a metaphysical defense of A-theoretic eternalism, see Chapter 3. For logical considerations, see Chapter 2.
whether it accurately reflects the metaphysics of change. And, as we’ve seen, this further question requires some heavy philosophy. Are there natural past and future analogue properties? Do objects endure or perdure? Do objects change with respect to existence? Are all temporary properties relations between an object and a time? Are there propositions? Are there primitive truth or existence properties? I submit that the pressing work for A-theorists is not devising more complicated logics for tense operators, but finding principled answers to these questions. And eternalist A-theorists especially should be open to the new logic. It perspicuously and parsimoniously reflects the basic ontological and ideological commitments of an A-theory, without forcing adherents to insist there is irreducible “tensed structure” in anything other than properties.

More ambitiously, developments in the logic of time often go hand-in-hand with developments in the logic of possibility and necessity. If we determine (SPL) with predicate modifiers provides a suitable background for the metaphysics of time, it might also provide an alternative to modal logic, at least for the rare metaphysician who denies there are any genuinely contingent existents.37 On the approach, we’d also treat “possibly” or “necessarily/essentially” as predicate modifiers.38 These are issues worth pursuing.


38 Wiggins develops a theory of “necessarily” as a predicate modifier and uses it to defend his essentialism from Quinean objections to quantifying into modal contexts. See Wiggins (1976). And in an appendix to the Wiggins paper, Peacocke develops a formal semantics for the necessity modifier. See Peacocke (1976). But Wiggins’ system is supposed to be added onto a logic with modal operators; it is not intended as a replacement.
Chapter 5
Change We Can Believe In (and Assert)

Speak what you think today in hard words like cannon balls and tomorrow think what tomorrow thinks in hard words again, though it contradict everything you said today. -Ralph Waldo Emerson (“Self Reliance”, 1841).

Propositional temporalists hold that at least one proposition changes truth value over time. This paper defends the view against objections that such propositions are unfit to serve as contents for belief and assertion. In Section 5.1, I explain the motivations for propositional temporalism and contrast it with propositional eternalism. In Section 5.2, I develop the “attitude problem” for propositional temporalism, tracing the problem to independent arguments given by Gareth Evans and Mark Richard. In Section 5.3, I argue that the most persuasive form of the attitude problem depends on three assumptions about assertoric and doxastic norms. The first norm dictates that speakers and believers aim at true contents. The second norm dictates that speakers and believers aim at completeness in their conversations and investigations. And the third norm dictates that speakers and believers aim for their contents to persist until the end of the investigation or conversation. Sections 5.4 through 5.6 consider responses to the attitude problem that amend one or another of these norms. I argue that there are viable solutions, and the best requires a new understanding of how temporalist propositions serve as contents.
5.1 Propositional Temporalism and Eternalism

The arguments of this paper will depend on two principles about propositions. First I’ll assume:

**Content:** Propositions are the contents of our beliefs and assertions.

According to the content assumption, when an agent believes or asserts that φ, she stands in a relation to some abstract object φ, a proposition. In what follows, I intend to be neutral on whether propositions are structured Russellian entities or sets of abstract possible worlds. The arguments should work on either approach. And I will offer some brief remarks on difficulties with centered worlds as contents.

Second I’ll assume:

**Accuracy:** If a proposition is true, then it accurately represents the structure of reality.

This should be fairly uncontroversial: if the proposition *that Obama is President* is true, that is because Obama has the property of being President. I don’t mean to suggest any stronger thesis, for example that all propositions have truthmakers. Some propositions can accurately reflect reality without being made true by anything in particular. For example, the proposition *that there are no talking donkeys* is true, it accurately reflects the dearth of talking donkeys in our world, but it is reasonable enough to suppose that nothing in particular makes this proposition true. I will, however, assume that propositions represent compositionally. Negation, conjunction, disjunction, conditionals, modals and other operators join simpler propositions to yield more complex ones and to reflect more complex structures. Here I’ll follow the convention of bracketing a proposition when I intend to be more explicit about its structure (i.e. *[φ]*) .
If we are serious about propositions in the ways indicated above, then our underlying metaphysics will inform our views about what we believe and assert. Here is an example from the philosophy of time. *Propositional temporalists* maintain that there is at least one proposition about a temporary event that changes truth-value over time. *Propositional eternalists* deny this—they maintain that all propositions about temporary events have a stable truth-value over time. As I write this sentence, New Brunswick is cloudy. The temporalist thinks that a proposition of the form $[\text{Cloudy}(\text{nb})]$ best expresses this state of affairs, because New Brunswick has the property of being cloudy *simpliciter*. This proposition is now true, but was false at some times in the past and will be false in the future. The eternalist thinks that a proposition of the form $[\text{Cloudy}(\text{nb},t)]$ best expresses the state of affairs, where $t$ rigidly designates the present time.\(^1\) New Brunswick has the property of being cloudy *at a particular time*. Here is another way to think of the distinction: eternalists think that all propositions about temporary events have ‘time slots’ that need to be completed by times (like *at 3:17pm on March 25th, 2009*). If the proposition does not represent a time, it is incomplete and so unfit to serve as a content. In contrast, temporalists think that at least some propositions about temporary events lack ‘time slots’, but nevertheless are thinkable, assertable contents.

Temporalists and eternalists likewise differ on the structure of propositions about the past or future. Most temporalists think that some past or future states of affairs are best represented by complex propositions with tense operators. For example, that New Brunswick will be cloudy is represented as $[\mathcal{F}\text{Cloudy}(\text{nb})]$. That McCain has never been President is $[\neg\mathcal{P}\text{Pres(mccain)}]$. Eternalists, in contrast, think that states of affairs in the past or future are best represented with past or future times or time variables in the proposition’s time slot. The fact that it was cloudy in New Brunswick...
Brunswick at some time in the past is best represented with quantification over times: where \( t \) rigidly designates the present and \( < \) abbreviates “earlier than”: \( \exists x (x < t \land \text{Cloudy}(nb, x)) \). Propositions like this never change in truth-value. Indeed the eternalists think that there is one and only one maximal, eternally true proposition that describes the world as it is at every time. Eternalists have no need for tense logic.

Why prefer one view over the other? Some of us get involved in the debate by way of metaphysics. Propositional temporalism finds support from adherents to the A-theory of time. A-theorists maintain that at least some objects undergo change without having time relational properties or temporal parts (without being “spread out” in time). Suppose you think the weather changes in accord with the A-theory: New Brunswick has the temporary, non-relational property of being cloudy, and New Brunswick does not have temporal parts. We most perspicuously capture the weather fact about New Brunswick with the proposition \([\text{Cloudy}(nb)]\). But this proposition had better be able to change truth value, because if we wait a bit, the weather clears, New Brunswick lacks this property, and \( [\neg \text{Cloudy}(nb)] \) is true. I am driven to temporalism because I endorse the A-theory of property change, and any metaphysically accurate propositions about the objects with A-properties will have to be temporalist propositions. But note that there are non-metaphysical defenses of temporalism as well. For example, Ludlow, Hawthorne and Cappelen seem attracted to the view because it provides an intuitive model for how we speak and reason about time.\(^2\)

Alternative metaphysical assumptions drive others to propositional eternalism. B-theorists of time hold that all change either requires that objects have temporal parts or requires that objects have time relational properties. Change is always explained by some kind of variation in the spatiotemporal manifold. If temporalism

\(^2\)Ludlow (1999) and Cappelen and Hawthorne (2009).
is true, some propositions change without having temporal parts or time-relational properties. They gain and lose the property is true (full stop). But this kind of change is inconsistent with the B-theoretic account. So assuming that propositions exist and are the bearers of truth and falsity, the B-theory entails propositional eternalism. Eternalism also finds favor with a growing number of metaphysically neutral semanticists, who think that quantification over times provides a superior framework for explaining phenomena like anaphoric reference in tensed expressions.\(^3\)

Metaphysically-driven propositional temporalism and eternalism will be the focus of this paper. But before we move into the arguments, two terminological cautions are in order. First, it is easy to confuse propositional eternalism with a cognate view—ontological eternalism. Ontological eternalists maintain that wholly past or future objects like King Henry VIII or my great, great grandchildren exist, in the same way present objects exist. Metaphysically serious propositional eternalism entails ontological eternalism, because if an existential claim like \(\exists x\text{Dinosaur}(x)\) is ever true, then it is always true. But not all ontological eternalists are committed to metaphysically serious propositional eternalism, because not all ontological eternalists think that eternalist propositions are the objects of our attitudes.\(^4\) Second, it is easy to confuse propositional temporalism with a related view in tense logic: semantic temporalism. Semantic temporalists deny that there can be any interesting eliminative analysis of tense operators.\(^5\) Barring additional assumptions, semantic temporalism and propositional temporalism are wholly independent views. Some semantic temporalists will deny that there are any propositions. Some propositional temporalists will deny semantic temporalism because they do not make use of tense

\(^3\)See Kamp (1968), Partee (1973), Enc (1986), and King (2007). I propose a somewhat different response to these issues in Chapter 3.

\(^4\)For example, David Lewis is an ontological eternalist who thinks that propositional attitudes are property ascriptions. See Lewis (1983). More on this in footnote 10.

\(^5\)For example, Prior and Fine (1977).
operators to express temporary propositions about the past or future. Still others will doubt there is a coherent notion of “reductive” semantic clauses. These issues need not especially concern us here. Throughout this paper I use “temporalism” and “eternalism” to mean propositional temporal and propositional eternalism and not these other views.

5.2 Do Temporalists Have an Attitude Problem?

Some arguments have gained prominence in the past few decades that attempt to embarrass temporalists who assume that such propositions can play a role as contents for beliefs and assertions. Chronologically, the first such argument comes from Gareth Evans. In “Does Tense Logic Rest on a Mistake?” he attacks temporalist accounts of assertion:

(Temporalism) is such a strange position that it is difficult to believe anyone has ever held it... we use the term ‘correct’ to make a once-and-for-all assessment of speech acts... if a theory of reference permits a subject to deduce merely that a particular utterance is now correct, but later will be incorrect, it cannot assist the subject in deciding what to say, nor in interpreting the remarks of others. What should he aim at?... Maximum correctness?7

And a bit further on he writes:

Utterances have to be evaluated according to what they rule out, and so different utterances of the same tensed sentence made at different times may have to be evaluated differently. They therefore cannot be assigned the same semantic value.8

6See Chapter 4.
7Evans (2002b, 349). Emphasis is mine.
8Evans (2002b, 350).
Evans uses “utterance” here, but we’ll understand it to mean assertion. It is not clear that any mere utterance is meant to rule out information—sometimes we speak just to make noise. As I read it, the Evans argument works like this. Temporalism assigns the same semantic value to “New Brunswick is cloudy” no matter when the assertion is made: the proposition \([Cloudy(nb)]\). Suppose the weather in New Brunswick frequently changes. And suppose I want to comment on our current overcast condition. In an idealized sense, the point of making an assertion is to share information with my conversation partners, so that by the end of the conversation, we all know more than when we started. Therefore, I should say something true, and I should intend for what I said to be believed by all of my partners at least until the end of the conversation. But if what I say is \([Cloudy(nb)]\), this will likely be false by the end of the conversation. Looking back on my assertion later, I will have botched it by contributing a false content. As Evans sarcastically notes, it would be silly for me to think it correct to assert that it is not cloudy just because \([\neg Cloudy(nb)]\) will be true for most of the conversation. But what other options do I have for deciding whether it is correct to contribute a temporalist content? If temporalism is true, it is not clear what we should aim for in making assertions and how we should judge speakers that end up speaking falsely. Evans thinks that communication without norms to decide these matters isn’t communication. So he concludes that temporalism is mistaken.

In his “Temporalism and Eternalism” paper, Mark Richard gives a similar style of argument against temporalism, only he targets its account of belief. Here is Richard’s argument, updated for modern times. Suppose in 2002 someone told Mary, “Bush is President and up to no good in the White House” and she believed it. Mary still believes everything she ever believed. What does Mary believe in 2009? The temporalist seems committed to the validity of the following argument:

\(1\) Mary believed that \([Pres(bush)]\).
(2) Everything Mary ever believed, she still believes.
(C) Mary believes that \([\text{Pres}(\text{bush})]\).

Premise (1) follows from temporalism and the content assumption. Premise (2) is meant to uncontroversially capture what it is for Mary to retain a belief. But the conclusion is absurd. Or so Richard complains: “This argument is not a valid argument in English... it would not only be uncharitable, but incorrect to infer (the conclusion).”\(^9\) Richard chalks up the invalidity to the temporalist proposition we ascribe to Mary and argues that we should instead ascribe eternalist propositions as her beliefs. We should do likewise for any other person who forms beliefs about events that change.

We must distinguish two of Richard’s charges. First he claims the Mary argument is not “valid in English.” In other words, Richard thinks that while it is natural for Mary to report “I believed that Bush was President and up to no good, and I still believe that”, it is not natural to conclude that Mary believes a proposition of the form \([\text{Pres}(\text{bush})]\). But I am honestly not sure what it means for any argument to be “valid in English”—validity is a property a formula can have only relative to a logical system. Our intuitions about validity are often unreliable before we’ve settled the logical form of an argument. Richard thinks the form of the Mary argument is:

\[
\begin{align*}
(1) & \ \mathcal{P}B(m, \phi).
(2) & \ \forall x(\mathcal{P}B(m, x) \rightarrow B(m, x)). \\
(C) & \ B(m, \phi).
\end{align*}
\]

This argument is valid with respect to even very weak quantified tense logics. If the temporalist concedes that this captures the structure of the informal Mary argument, she should insist that the argument is valid. But it is an open question whether this

is the right form of the English argument. In particular, we might wonder whether (2) captures the correct logical form for “Mary has retained every belief she has ever formed”. We’ll return to this question in Sections 5.4 and 5.5, when we consider in more detail what it is for a rational agent to retain a belief.

Set aside Richard’s first objection momentarily. His second charge is more pressing—and it is a complaint that Evans shares. If we ascribe temporalist propositions to agents, we are being uncharitable: temporalism forces us to interpret them as constantly failing. Over time, I don’t communicate the state of the weather, and Mary develops an inaccurate view of domestic politics, because the contents of our beliefs and assertions cease to accurately represent reality. Put more generally: eternalist propositions can make a lasting contribution to conversations and investigations, while temporalist propositions cannot. We often (when things go right) make lasting contributions to conversations and investigations. So our contributions to conversations and investigations must be eternalist propositions. I will call this simple two-premise argument the Evans-Richard argument for propositional eternalism. The argument especially stings any A-theorist who believes that propositions both represent reality and play a central role in explaining our beliefs and the beliefs we cause in others.\(^{10}\)

In the remainder of this paper, I will argue that the Evans-Richard argument is unsound, because it assumes an incorrect model for belief and assertion. To my knowledge, nobody so far has connected the two lines of arguments in any detail,

\(^{10}\)It is worth noting that A-theorists are not the only party in this debate who face a problem explaining propositional attitudes. Propositional eternalists have long struggled with how to explain the difference in cognitive significance between temporalist and eternalist contents. For example, consider \([\text{Leaving}(\text{bus})]\) and \([\text{Leaving}(\text{bus}, 9\text{pm})]\). Mike might be aware that the bus is leaving at 9pm. But suppose he loses track of time and someone bursts into the room, exclaiming “The bus is leaving!” It seems Mike learns something new that cannot be captured by just the eternalist proposition. It seems Mike’s coming to learn the temporalist proposition explains why it is rational for him to leap up and run for the bus. To handle problems like this, many B-theorists turn to de se contents. They deny that all propositional attitudes are relations between an agent and a proposition. Rather, having an attitude is self-ascribing a property. Lewis is the most prominent advocate of this approach; see Lewis (1983, 133-155). The idea of belief as self-ascription is first formulated in Chisholm (1981), but Chisholm does not bring it to the aid of eternalism in the way Lewis does.
so in Section 5.3, I will show how they generalize. In Section 5.4, I will argue that the argument improperly assumes that our contributions to conversations and investigations should persist. I will explain how this error comes from misinterpreting an otherwise useful background model for rational assertion and belief. And I will argue that temporalists should endorse tracking norms for belief and assertion: conditional norms whose directives change systematically with the world. I’ll propose two such norms and show how they answer the puzzle. Finally, in the remaining sections, I will consider some alternative solutions to the attitude problem and weigh their costs.

5.3 The Common Thread- Goals of Belief and Assertion

Most of our beliefs and assertions have a teleology—they aim at something. A theory of communication should identify the goal of assertion and show the most efficient ways to realize the goal. Likewise a theory of investigation should identify the goal of belief and show the most efficient ways to get there. At least in this respect, epistemology and philosophy of language share an interest with ethics. A theory of right action identifies the goal of action and the means to pursuing that goal. Simple utilitarians, for example, think the goal of our actions is total utility, and the norm to achieve the goal consists in always choosing actions that maximize expected utility. Explaining utilitarianism just is identifying this goal and attendant norms for action.

The proper aim of a belief system is a complete and accurate representation of reality. The proper aim of assertion is to share beliefs to aid our conversation partners in forming their complete and accurate representations of reality. Robert Stalnaker offers perhaps the most elegant theory of this process in “Assertion.” He writes:

A context set is the set of possible worlds recognized by the speaker to
be the “live options” relevant to the conversation. To engage in conversation is, essentially, to distinguish among alternative possible ways that things may be. The purpose of expressing propositions is to make such distinctions.\(^{11}\)

An example clarifies the theory. Say you and I have a conversation about Abraham Lincoln. At the start of the conversation, I have only one relevant belief, namely that Lincoln was a President: \([\text{Pres}(l)]\). (I’ll use the temporalist form for convenience.) I am open to a huge range of other possibilities. Suppose you also have only one relevant belief, namely that Lincoln was a midwesterner: \([\text{Midwestern}(l)]\). I assert, “Lincoln was a US president” and you reply, “And he was from the Midwest.” We both update our beliefs to include \([\text{Pres}(l) \land \text{Midwestern}(l)]\). A few seconds into our conversation, progress has been made. Whereas before it was an open question for the conversation whether Lincoln was from Florida or Alabama or what his occupation was, we have now each ruled out some live possibilities. Our individual beliefs about Lincoln are the better for it.

In investigations and conversations, our idealized goal is to believe and cause others to believe the proposition that picks out exactly one possibility—the actual world.\(^{12}\) Call this the goal proposition. Norms for assertion and belief steer us in the direction of the goal. We measure assertoric or doxastic success in terms of how much closer or further our assertions or beliefs take us from this goal. If our assertions or beliefs are always ruling out merely possible worlds, we are doing well. If our assertions or beliefs rule out no worlds, we’ve stalled. If our assertions or beliefs rule out the actual world, we’ve failed. The best assertoric and doxastic agents move most efficiently to the propositions most similar to the actual world. Bad agents move away from the actual world, eliminate it from the context set quickly,

\(^{11}\)Stalnaker (2003a, 85).

\(^{12}\)Or perhaps it picks out a unique set of logically equivalent possibilities. This makes no difference to the arguments here. If you prefer the set view, simply substitute “unique set of maximal, consistent propositions” for “goal proposition” in everything to follow.
or (in the worst scenario) eliminate every possible world by introducing inconsistent contents. Conversations or investigations begin because agents haven’t identified the goal proposition. And in the perfect situation, they end with only the goal proposition remaining in the field of live possibilities.

The norms for forming beliefs and making assertions should follow from this goal of an accurate representation of reality. And it seems they do. For example, consider the most widespread norm:

**Truth:** Do not assert or believe false propositions.

Necessarily, if you believe or assert a false proposition, then you do not believe or assert any part of the goal proposition. So you move further from the goal.

Less discussed but just as important is:

**Quantity:** Believe and assert the most complete, consistent propositions you can.

Aim to have detailed beliefs about the world. Do not believe vaguely when you can believe precisely. Draw as many legitimate distinctions as possible. Aim to eliminate live possibilities. **Quantity** is also entailed by the goal. Our goal is actuality. The actual world is described by a maximal, consistent proposition: for every simple proposition that exists, either it or its negation is a conjunct of the complex proposition. If we do not at least aim for completeness, we won’t “zero-in” on the goal proposition, distinguishing it from alternatives.

A third norm is also in the background of the Evans-Richard argument:

**Persist:** Intend for your contributions to investigations and conversations to persist and to be relied upon in the future (at least until the end of the investigation or conversation).
We see evidence of this norm in Evans’ claim that assertions are evaluated according to what they rule out “once and for all.” And PERSIST seems to be a natural extension of Stalnaker’s model. When we begin an investigation or a conversation, we are entertaining a high number of live possibilities. We wish to reduce this number without eliminating the goal proposition. If our contents did not persist in their contribution to the context set, we’d have no means for reducing possibilities. We’d be bumbling Clouseaus, forgetting our evidence as soon as we acquire it.\footnote{And in Bayesian implementations of the Stalnaker model, we see a version of this norm in the principle that rational agents never update on propositions they are certain of.}

Of course, investigations and conversations are also ruled by other, more pragmatic norms. Don’t go on for too long, obey some standards of contextual relevance, and so on. And if we assign credences to beliefs, then there will be additional norms for updating these. Set aside pragmatic and probabilistic concerns for our purposes and focus on just the idealized model of belief and assertion. If we endorse the Stalnaker picture—and I think we should—it seems natural to believe that TRUTH, QUANTITY, and PERSIST are the basis for deciding what to say and believe and the basis for evaluating the assertions and beliefs of others. And if this is right, we should expect the three norms to be compatible: a very effective agent could adhere to all three. We can now show with quick reductio arguments that if the three norms are compatible, temporalism is false.

Take the case of belief first. Imagine a perfect believer: God. God only believes truths, all of his beliefs are maximal, all are consistent, and all of them persist. God never discovers he is wrong, never revises his beliefs, and is never surprised by new evidence. Further, God has access to all of the propositions that there are, including the temporalist ones. (He’s not an “atemporal” deity.) If the norms are compatible, then the perfect believer is possible. Suppose it is 2002, and God believes the goal
proposition and only the goal proposition. The goal proposition includes that Bush is President, Lincoln was President, etc: \([Pres(b) \land \forall Pres(l) \land \ldots]\) By assumption the goal proposition is maximal consistent, true, and God persists in believing it. So in 2009, God still believes \([Pres(b) \land \forall Pres(l) \land \ldots]\) But now what God believes is false, because Bush is not president. Obama is president. So God is not a perfect believer.

Now take the case of assertion. Imagine God is the perfect assertoric agent. In conversations with God we always receive true, perfectly reliable, and perfectly precise information. On Day 1, Moses goes up the mountain to talk with God. God decides to share with him the one true, maximal consistent proposition. God says, “Let’s start with the Israelites. They are faithful, there are no golden calves, there will be a golden calf...” God’s assertion goes on and on for several days. When God started the Israelites didn’t have any golden calves. On Day 3 they made one. So on Day 3, one conjunct of God’s asserted proposition— \([\neg \exists x(Calf(x) \land Golden(x))]= false\) is false. So the whole proposition is false. He is no perfect asserter.

In both cases we assumed that temporalism is true and that the three norms are compatible. And we reached a contradiction. As it stands, this broadly Stalnakerian framework excludes temporalism. But the framework is very attractive as a theory of belief and assertion. So how much of it can be retained by temporalists? Is there a theory of belief and assertion that is neutral with regards to the metaphysics of change? And if one of the A-theories is true, how do we speak and reason about an ever-changing world?

There are at least four open lines of response to the attitude problem for temporalism. First, one might reject TRUTH as a norm for belief and assertion. John MacFarlane has argued for this as a response to the Evans argument. In Section 5.6, I will consider this option and argue that it goes too far. Second, one might reject QUANTITY. I will not consider this option in any detail in this paper because I cannot
see any non-pragmatic objection to the norm, and because I suspect we could reconstruct the perfect believer/asserter arguments without it. Third, one might identify a different mechanism by which beliefs and assertions persist—one that avoids the reductios but upholds PERSIST. I will consider this option in Section 5.5 and argue that this reply is too weak. Finally, one might deny PERSIST. This is the reply I favor, and it is the option to which we now turn.

5.4 My Favored Reply: Tracking Norms

As we’ve seen, the norms governing assertions and belief crucially depend on how we characterize the goal proposition. Should the temporalist agree with the characterization underlying the PERSIST norm? I think not. But first a helpful parable:

*HAROLD AND KUMAR*: Harold and Kumar are hungry and decide to drive to the White Castle restaurant in New Brunswick. They agree to do what it takes to get to White Castle: pooling gas money, sharing maps, and temporarily abandoning other pursuits. When they leave their house at 3:00pm, White Castle is open. Enroute they hear over the radio that citywide power outages have closed the restaurant.

Does Kumar still have any obligations to share White Castle-directed resources with Harold? He does not. Effectively there is no goal for their journey. He might have a more general obligation to make sure that Harold gets home safely. He might adopt new specific obligations by choosing to drive to the White Castle in Paramus. But as the specific goal no longer exists, it is *pointless* for Kumar to share maps of New Brunswick with Harold or for them to continue driving down Route 1. And pointless obligations aren’t obligations at all. Suppose instead that Harold and Kumar set out with a more general goal: to get White Castle burgers in the most efficient way they can. Then the specific obligations they undertake change whenever the environment
changes. If New Brunswick is the closest restaurant, they should head there. But if the New Brunswick location closes, they should divert their resources to Paramus. Their plans should track the location of the closest open White Castle. Their adventure will end either when they find an open one or it becomes impossible to fulfill the goal.

How does the parable bear on temporalism? I’m a temporalist because I am an A-theorist, and I am an A-theorist because I think change is something above and beyond mere variation in a spacetime manifold. Some objects have temporary properties *simpliciter*, and when these properties change, propositions change truth values in step. So the maximal, consistent proposition describing how the world is will be false very soon. (Pause.) It is false and another proposition is true. Our goal proposition is a moving target. This robust change is not a problem if we limit our investigations and conversations to eliminating possibilities about the past. Past propositions will never change truth-value. But if we wish to make a comment or form a belief about the present or future, we must recognize such aims are ephemeral. Propositions about temporary events in the present or future cannot make an enduring contribution to the conversation or investigation, because the goal proposition can undergo change with respect to these conjuncts. When we aim to eliminate present or future possibilities, temporalists should not follow PERSIST without qualification. It would be as pointless as Kumar setting out on a trip to White Castle and committing to spend his time and money on the journey, even if the restaurant closes.

This observation helps us to diagnose the issues with Mary, God, and our conversations about the weather. Recall the form of Richard’s Mary argument:

1. Mary believed that \([\text{Pres}(bush)]\).
2. Everything Mary ever believed, she still believes.
3. Mary believes that \([\text{Pres}(bush)]\).

The temporalist should view the argument as valid and sound, assuming the logical
form of the argument is as we represented it in Section 5.2. But the temporalist should also think it appropriate to to criticize Mary. She should not believe everything she once believed if part of what she once believed was present-tensed (as it is above). Mary is slavishly following the unqualified PERSIST norm. It is much easier to see the foolishness when we plug a future-tensed proposition in place of the present one. Say Mary believed on Tuesday that there will be a sea battle on Wednesday. Wednesday comes and goes. On Thursday, Mary still believes everything she ever believed—namely that there will be a sea battle on Wednesday. Not only is Mary’s belief false, she is unresponsive to the passage of time.

What should we say in response to Evans’ argument? Any time I make a present-tensed assertion like “It is cloudy,” I am merely conditionally helping us get to the temporary goal. As soon as the weather changes, what I’ve asserted is false. But I have done nothing wrong as a speaker, because the PERSIST norm is contingent on a relevant goal existing. If the goal changes with respect to the feature at issue, then I am free to aim at a new goal.

And what should we say about the perfect believer and asserter arguments? If epistemic mortals are not bound by unqualified PERSIST when they form present or future beliefs, then God is surely not bound by the norm. Still, we can say more about these cases. The perfect believer or asserter has the distinction of being able to reach the goal proposition immediately. He already knows it. Should the perfect believer and asserter still be bound by TRUTH and QUANTITY? Of course. Any belief or assertion that is sub-maximal or false would move God away from the goal proposition. TRUTH and QUANTITY are constitutive norms. They are entailed by what the goal proposition is, namely a true, maximal, and consistent proposition. But PERSIST seems to be justified not by the goal, but by QUANTITY and the fact that imperfect believers and asserters cannot immediately reach the goal proposition. PERSIST is an instrumental norm—we follow the norm only to the extent that it takes
many stages in an investigation or conversation to arrive at the goal proposition. So even the eternalist should agree that it is a norm which only binds us to the extent that we fall short of Truth and Quantity. In practice this always happens. But if the temporalist is forced to choose a norm to abandon, he should always prefer to drop instrumental norms before constitutive norms. Dropping Persist could be consistent with the broadly Stalnakerian model of investigation and communication, but dropping Truth or Quantity could never be.

We should abandon Persist, but what should we put in its place? We are epistemic mortals, struggling to grasp the most accurate, true proposition describing the world. Our conversations and investigations take time to conduct. And we’re temporalists, so we think that over time the goal propositions will change, because the truth-values of propositions about the present and future keep changing. None of our present or future-tensed beliefs or assertions can make a lasting contribution to getting us toward the most accurate representation of the world. With this background picture, present and future-tensed beliefs and assertions seem pointless—they are aimed at an elusive goal. So we still haven’t quite met the burden of answering the attitude problem. How do we decide what to say about the present and future? And what role, if any, could temporalist propositions play in our belief systems?

To make the problem even more stark, consider a thought experiment:

_HORSE RACE_: Suppose Harry and Marv know all of the same eternalist propositions. They are watching a horse race together, each from a slightly different vantage, narrating events as they happen. At the start of the race, Marv asserts “The gun fires, they’re off, and all of the horses are evenly matched!” Seconds later, Harry asserts, “Maverick takes the lead!” Marv adds, “But Secretariat closes the gap!” A few seconds later, Marv: “Now Secretariat is ahead!” And a few seconds later, Harry: “Secretariat wins!”

\[14\] Thanks to Dean Zimmerman for suggesting this case.
Here are some beliefs that temporalists ought to have about the case: (1) Harry and Marv are having a conversation about a horse race, (2) each is advancing the conversation with his assertions because each is contributing new content, and (3) the conversation lasts (at least) from the start of the race to Secretariat’s victory. Now we see trouble. The goal proposition changes at least four times in the course of the conversation. Are Marv and Harry’s assertions distinguishing possibilities in the same context set? If not, it seems they are not having a conversation, at least not by the Stalnakerian model. Does one conversation begin and another end each time the goal shifts? If not, then the conversation doesn’t last as long as the race. So how do temporalist propositions engage with the context set? Intuitively, conversations and investigations can survive some changes in temporalist conjuncts of the goal proposition. And temporalist contents advance conversations and investigations only when the agents involved in the investigation and conversation intend to track changes in their truth values. Marv asserting “Secretariat closes the gap!” must prompt some kind of lasting change in the context set. We need norms that will ensure our beliefs and assertions both respond to anticipated changes in the goal and make lasting contributions.

This all suggests a solution to our problem. Here are two norms agents might follow to track changing goal propositions, one for the present and one for the future:

(1) **Present Track:** If you form a belief in or assert a proposition of the form \([\phi]\) about a present, temporary event, then intend for the content of your belief or assertion to persist with two qualifications:

(i) intend for the content of your belief or assertion that \([\phi]\) to expire if \([\phi]\) is false and you have no new evidence that \([\phi]\) was false when initially believed or asserted; and

(ii) intend to believe or assert a complex proposition of the form \([P\phi]\) if \([\phi]\) is false and you have no new evidence that \([\phi]\) was false when initially believed or asserted.

(2) **Future Track:** If you form a belief in or assert a proposition of the
form $[\mathcal{F}\phi]$ about a future, temporary event, then intend for the content of your belief or assertion to persist with two qualifications:

(i) intend for the content of your belief or assertion that $[\mathcal{F}\phi]$ to expire if $[\mathcal{F}\phi]$ is false and you have no new evidence that $[\mathcal{F}\phi]$ was false when initially believed or asserted; and

(ii) intend to believe or assert a simpler proposition of the form $[\phi]$ if $[\mathcal{F}\phi]$ is false and you have no new evidence that $[\mathcal{F}\phi]$ was false when initially believed or asserted.\textsuperscript{15}

It is essential that we distinguish content expiration from content falsification, and we do this by paying attention to the evidence that triggers the agent’s updating. A content merely expires if the agent becomes aware that it is false and the only relevant evidence for its falsity is that time has passed. A content is falsified if the agent becomes aware that it is false and has relevant evidence that it was false when first contributed to the context set. So suppose its Tuesday and Mary believes that there will be a sea battle tomorrow. Wednesday comes, and Mary realizes her belief is false. It may be that her belief has merely expired, the sea battle is presently occurring (assume it will only last a short time), and she should believe that it is presently occurring rather than that it is in the future. Or it may be that she was mistaken in her prediction, and the belief is falsified because the battle was called off. In this second case, she should not believe that there is a sea battle presently occurring. Mary should never have believed there would be a sea battle, and she wouldn’t have if she had had some salient evidence about the future, namely that it would be called off. The relevant difference is that in the latter case Mary was at fault in forming the initial belief. In the former case, even though what she believed is now false, she was entirely justified in believing it. Good temporalist theories of content

\textsuperscript{15}These tracking norms can be amended to accommodate different formalizations of tense. For example, some temporalists will make use of more fine grained metrical operators like “It will be the case in two days that...” When an agent updates a proposition with a metrical tense operator like $[\mathcal{P}_n\phi]$, she should intend to believe $[\mathcal{P}_{n-1}\phi]$ when 1 unit of time has passed. Likewise, if we dispense with tense operators in the way proposed in Chapter 4, agents should intend to ascribe a past tensed property to an object when that object no longer has the A-property \textit{simpliciter}. I set aside these details in implementation for present purposes.
should be able to distinguish between the kind of updating that is appropriate when a
goal changes and the kind of updating that is appropriate because an agent’s original
belief or assertion was mistaken. And the tracking norms solve the charity problem
for temporalist contents: there is nothing uncharitable in attributing temporalist
propositions so long as agents are expected to follow the tracking norms.

Present Track and Future Track help us to update in response to changes
in the goal and they explain how temporalist contents can indirectly prompt lasting
contributions to context sets. They have the added benefit of being consistent with
temporalism without begging any questions against propositional eternalists. Eter-
nalists are never required to believe tensed propositions. The antecedent of Future
Track is never true on eternalism, so the consequent is never applied. Sometimes the
antecedent of Present Track is true on eternalism. But because the relevant \[\phi\]
cannot change truth-values, agents need never believe or assert propositions modified
by tense operators. They need only intend to believe them if \([\phi]\) changes truth-value.
And this is surely the right result; if \([\phi]\) changes truth-value, then eternalism is false.

Unlike unqualified Persist, Present Track and Future Track deliver an
informative, accurate theory of communication and investigation without presuppos-
ing a particular metaphysics of time or change. And if these norms are understood as
implicit features of the framework, then the Evans-Richard argument fails. Of course
there are some costs to adopting these two norms. First, though they are strictly
consistent with eternalism, they will certainly strike many eternalists as bizarre and
idle norms. To the extent that norms should be useful guides to communication and
belief, Present Track and Future Track are not wholly innocent. Second, un-
lke Truth, Quantity and unqualified Persist, they are somewhat complicated,
conditional norms. If we could make the Stalnakerian framework amenable to tem-
poralism with simpler, more categorical norms, perhaps this would be preferable. In
the remaining sections I will consider two such alternative proposals.
5.5 Reply 2: Double the Content?

Recall the Mary argument. Richard maintains that the correct logical form of the argument is:

\[
\begin{align*}
(1) \ & \mathcal{PB}(m, \phi). \\
(2) \ & \forall x (\mathcal{PB}(m, x) \rightarrow B(m, x)). \\
(3) \ & B(m, \phi).
\end{align*}
\]

where (2) is meant to capture “Mary still believes everything she ever believed.” Some temporalists will reasonably deny that the logical form of belief persistence is so straightforward. They’ll maintain that for the argument form to be valid, the quantifier in (2) must be tacitly restricted either to propositions that will not change truth-value. The majority of temporalists are conciliatory—they admit there are many propositions about temporary events that do not change truth-value over time. But they think there is another layer of temporalist propositions on top of these. So if Obama is President now, there are two true propositions about the event: \( [\text{Pres}(\text{obama})] \) and \( [\text{Pres}(\text{obama}, 2011)] \). For the conciliatory temporalist, most tensed assertions like “Obama is President” are ambiguous. They can pick out either of these propositions or their conjunction. In contrast, non-conciliatory temporalists think that no propositions about temporary events are eternally true.

The conciliatory temporalist has a ready answer to the Evans-Richard problem. He has a stock of unchanging propositions about temporary events at his disposal. According to the proposal, in 2002, when Mary originally forms the belief that Bush is President, she believes: \( [\text{Pres}(\text{bush})] \) and \( [\text{Pres}(\text{bush}, 2002)] \). Her belief in the former proposition prompts her to make indexical assertions like “Bush is President now” and explains her disposition to rush to Washington when she wants to see him. Her belief in the latter explains how her attitude lasts through time. The conciliatory
temporalist will say that Mary’s belief about the Bush administration survives so long as she continues to believe the eternalist proposition.

Still there are at least three difficulties for this conciliatory strategy. First, the Evans-Richard argument gets it force because we assume that a single kind of content both accurately represents the world (i.e. accurately represents the nature of temporary properties like is President) and is what our beliefs and assertions are about. But the conciliatory temporalist cannot save both the content and accuracy assumptions, at least not in their current forms. The eternalist propositions do the lion’s share of the work in explaining what an agent aims to acquire in investigations and what he aims to impart in conversations. But the eternalist proposition does not accurately represent a temporary property like is President, because (by assumption) it is an A-property and not time relational. So the temporalist can no longer claim that what we rationally believe and assert over time are also what most accurately represents reality.

Second there are propositions some temporalists think change truth value but that do not have any nearby eternalist proxy. For example, suppose Mary believes Obama exists, but only temporarily. She thinks he will cease to exist when he dies. Mary believes [∃x(x = obama)]. This proposition will change truth value at some point in the future. But there is no eternalist proposition corresponding to this content, because existence and bare identity aren’t possibly time-relative (at least on the usual neo-Quinean picture). So we’ll need some alternative strategy if we wish to account for agents updating beliefs about temporary existence.

Third, we might worry that the conciliatory strategy is vulnerable to a kind of information puzzle. Consider this case:

**PRISON NEWS:** In 2000, Mary is locked in solitary confinement. As part

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16I am grateful to Andy Egan for discussion here.
of her punishment, she is not allowed to know the time, day, month, or year. Every day she is given a copy of the *New York Times* with the dates blacked out. One day in 2003, on the basis of the newspaper, she forms the belief that Bush is President. When she is freed in 2009, Mark asks her what she was able to learn about the outside world during her confinement. She reports, “I learned about Bush’s Presidency.”

While in prison, Mary believed the temporalist proposition \([Pres(bush)]\). She was not able to form the belief \([Pres(bush, 2003)]\), because she didn’t know what year it was. So the belief she retained throughout her captivity couldn’t have been \([Pres(bush, 2003)]\). Still it seems like she did acquire a belief about the Bush Presidency, and she faultlessly retained it. We can explain this on the tracking theory. Mary didn’t retain any particular content. Rather, when she formed the belief in the first instance, she intended to update it to \([PPres(bush)]\). That’s what she believes now, and it is that content she means to share when she tells you what she learned during her incarceration. Pressed with a Richard-style objection, this is what she’ll report. If Mark insists, “Mary, surely you don’t still believe Bush is President!” She’ll reasonably reply, “What I mean is I (now) believe that Bush was President, and I believe this because I learned about the Bush administration back in captivity.” The belief in the first temporalist proposition lead to her belief in the second, by way of the tracking norm. When did her belief shift? It probably happened gradually, as her credence that \([Pres(bush)]\) waned. What matters is the conciliatory account of belief retention cannot be the whole story, because it cannot account for belief retention in cases where agents do not fix the particular time.

There is another option for replying to the *PRISON NEWS* case that might better uphold the conciliatory strategy. Suppose Mary develops a little ritual to help manage the psychological torment of her captivity. Every time her captors bring her a meal, she gives a new name to the time interval that elapsed since the previous meal. On the morning she received the *New York Times*, Mary decreed “Let \(t_{1000}\) name this current
interval between meals.”¹⁷ Mary then formed the belief \([Pres(bush, t_{1000})]\). Could this kind of content explain the persistence of Mary’s beliefs? Maybe. But contents like this will be of very limited use in distinguishing possibilities in the context set. Mary will never know that \(t_{1000}\) is 2003. If she tells Mark that she learned “that Bush was President in \(t_{1000}\)”, this will not help him to distinguish the possible world where Mary learned \([Pres(bush, 2003)]\) from the worlds where she learned \([Pres(bush, 2004)]\) or \([Pres(bush, 2005)]\).

As it stands, eternalist propositions are only of limited use in answering the attitude problem. I think any upshots of this proposal are more easily accommodated in the tracking theory offered in Section 5.4. But the conciliatory strategy is at least a back-up option that temporalists can keep available.

### 5.6 Reply 3: Reject TRUTH?

I’ve raised some issues for the unqualified PERSIST norm and suggested a replacement for it. But John MacFarlane proposes an alternative response to the attitude problem. MacFarlane’s account of future-tensed assertions faces a version of the Evans-Richard argument. In addressing the problem, he rejects TRUTH as a norm for belief and assertion. I’ll close with some thoughts on this approach.

MacFarlane arrives at the Evans-Richard problem through a circuitous path. Normally we only consider the time of utterance when evaluating the truth of an asserted proposition. If I assert “New Brunswick is cloudy” at 3pm, what I assert is true if and only if \([Cloudy(nb)]\) is true at 3pm. If I assert “It will be cloudy at 4pm” at 3pm, what I asserted is true just in case some proposition like \([FCloudy(nb, 4pm)]\) is true at 3pm. MacFarlane denies this simple picture of future-tensed assertions. In a

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¹⁷ This is similar to a proposal that Sarah Moss offers for explaining de se updating about times. See Moss (Forthcoming).
series of recent papers, he builds a case that two contexts play a role in determining the truth-value of future-tensed assertions: the time when the assertion is made and the time when the assertion is evaluated.\textsuperscript{18} According to MacFarlane, at 3pm, my assertion “It will be cloudy at 4pm” lacks a truth-value.\textsuperscript{19} At 5pm, it can be evaluated as true or false depending on the weather around 4pm. Indeed, the content only has a truth-value from 4pm onward. Call this model relativism about tensed contents. Relativism is supposed to better capture beliefs that the world is indeterministic and the future is open. As the open future is often a component of A-theories of time, relativism is an attractive semantics for some A-theorists.

But as MacFarlane realizes, relativism complicates the Truth norm. Any future-tensed assertion lacks a truth-value at the time it is made. So how does an agent decide what to believe or assert about the future? And how can we judge an agent for forming certain beliefs or making certain assertions about the future? The contents of his beliefs and assertions are not (yet) true or false given relativism. \textit{A fortiori} they are not false. So all future-tensed assertions and beliefs satisfy the Truth norm as I’ve stated it. But surely not all future-tensed assertions and beliefs are created equal. My belief that it will rain in an hour seems appropriate given the current overcast condition. My belief that the world will end in a nuclear holocaust in an hour seems totally inappropriate. How do we separate good assertoric and doxastic agents from poor ones on MacFarlane’s relativism? Note that strengthening the Truth norm is no help for relativism. We might replace Truth with:

\textbf{Strong Truth:} Only assert or believe truths.

But on this strengthening, we should not believe or assert \textit{anything} future-tensed,

\textsuperscript{18}MacFarlane (2003) and MacFarlane (2005).
\textsuperscript{19}MacFarlane assigns truth-values directly to utterances, a feature of his theory that prevents him from being a genuine temporalist by my account. But this doesn’t matter for our purposes.
because no future-tensed assertion or belief has a truth-value at the time it is formed. Surely the best believers have some beliefs about the future; the best conversation partners can say something about the future. **STRONG TRUTH** is too strong to model appropriate belief or assertion.

MacFarlane responds to the problem by rejecting both **TRUTH** and **STRONG TRUTH** as norms. In “Future Contingents and Relative Truth” he addresses the Evans argument, writing:

> It is not obvious that ‘aiming at the truth’ should play any part in an account of assertion. If we aim at anything in making assertions, it is to have an effect on other people: to inform them, persuade them, amuse them, encourage them… Even if we limit ourselves to sincere assertions, truth is only our indirect aim: we aim to show others what we believe, and we aim to believe what is true.\(^{20}\)

Elsewhere, MacFarlane realizes that a similar problem could arise for belief in future contingents and generalizes his response:

> There are many dimensions along which beliefs can be assessed as correct or incorrect. If you have patiently gathered the evidence and it overwhelmingly favors not-p, then there is an important sense in which it would be wrong for you to believe p, even if p happens to be true.\(^{21}\)

These issues are supposed to give us reason to doubt that the goal of our investigations and conversations is a complete and accurate representation of reality. Surely he is right to note that there is more to being a good doxastic and assertoric agent than merely aiming at the truth. Are these good enough reasons to abandon **TRUTH** as a norm of belief and assertion?

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\(^{20}\)MacFarlane (2003, 334).

\(^{21}\)MacFarlane (2005, 333).
MacFarlane’s relativism *forces* him to reject the TRUTH norm and replace it with alternatives. And he does suggest alternatives. According to MacFarlane, we assess the correctness of belief and assertion based on a cluster of considerations, in particular: agents’ willingness to withdraw false assertions, provide justification, and accept responsibility when they mislead others.\(^{22}\) Accuracy is no longer the primary aim of content. But as we’ve seen, the temporalists have options in responding to the attitude problem, especially temporalists who reject relativism. I think non-relativist temporalists should be reluctant to follow MacFarlane’s lead.

First, we can answer his objections by adding norms rather than dropping TRUTH. Whatever the correct theory of justification is, there will probably be a norm guiding us to aim for justification in our beliefs and assertions. For example, we might even go as far as Timothy Williamson and replace TRUTH with a norm that explicitly entails both accuracy and justification.\(^{23}\) Williamson thinks the norm we ought to follow is:

**KNOW:** Only assert or believe knowledge.

This seems a harsh standard to anyone who does not adopt Williamson’s knowledge-first epistemology, but it solves the problem of falsely attributing epistemic success to bumbling agents who just happen to arrive at the truth. And as knowledge is factive, KNOW entails that we still aim at the truth in our contributions to conversations and investigations. The upshot? There is no way to tell in MacFarlane’s examples whether truth is beside the point or whether we simply lack an additional justificatory norm.

Second, MacFarlane’s relativism has difficulty accounting for retrospective assessments. Suppose in 2006 Mary predicts Obama will be elected President and tells

\(^{22}\)See MacFarlane (2005, 334-338).

\(^{23}\)Williamson (2000b, 238-269).
Mark her prediction. Now it is 2010 and the Obama administration is in full-swing. It seems natural and correct for Mark to assert, “What Mary said was true.” But on relativism, the proposition that Mary expressed was neither true nor false in 2006. The tracking theory has no such difficulties. What Mary expressed in 2006 was true in 2006, namely \([Elected(\text{obama})]\). That proposition is now false. But Mary was faultless in asserting it back in 2006, and there is no special reason for her to need to justify it now. Why is this? It was true and informative, and she intended for it to expire and be replaced with a new content in accord with the tracking norms. Tracking theorists can straightforwardly account for retrospective assessments in ways that relativists cannot.

The final reason to avoid following MacFarlane is more blunt, but to my mind most forceful. I insist that rational agents in normal circumstances are after the truth. It is a mitigating circumstance—a norm for assigning blame—if a subject asserts or believes something based on overwhelmingly misleading evidence. But when I set out to investigate a matter or hold a serious conversation, I’m not aiming just to follow the evidence or conversation wherever it leads—I intend for it to lead to the truth. To drop Truth entirely is to deny there is ever a single goal proposition for investigations and conversations. I am not prepared to deny this if I can deny anything less. So I think non-relativist temporalists can and should preserve as much as possible of the Stalnaker model by adopting the tracking theory instead. But A-theorists with more open-future leanings might find the special benefits of relativism worth the cost.

5.7 Conclusions

Let’s recap. Propositional temporalism goes hand-in-hand with the A-theoretic view of time and some very plausible assumptions about propositions. The attitude problem attempts to demonstrate that temporalist propositions cannot play one of their
central roles—namely serving as contents for belief and assertion. But as we have seen, the attitude problem only arises from a naive assumption about the goals of investigation and conversation. Once we realise that the goal of our inquiry can undergo change, we should adopt conditional, tracking norms for contents rather than aiming to make “once-and-for-all” contributions to investigations and conversations. This readily solves the attitude problem and with fewer costs than alternative proposals.
Appendix A
The Logic of Tense Modification

The Tense-Operator-Free A-Theory’s logic is a variant of predicate logic with an expanded language, a new formation rule for modifiers, and an expanded semantics. The tricky part, as we’ll see, is devising a compositional semantics for non-standard modifiers. Note, other logics with predicate modifiers could give special inference rules and straightforward semantic clauses for standard modifiers—ones where having the property denoted by the predicate-modifier phrase entails having all of the properties denoted by the modified predicates. I ignore this here, in the interest of simplicity and because the proposed tense modifiers are non-standard.

(1) The Lexicon:

Where $n$ and $i$ are any positive integers:
Terms (constants or first-order variables): $a_1 \ldots a_n$, $x_1 \ldots x_n$...
Predicates and Second-Order Variables: $\neg$, $G^n$, $H^n$...
Predicate Modifiers: $M^n_n$, $M^n_{n+i}$...
Truth-Functional Connectives: $\neg$, $\rightarrow$.
Quantifiers: $\forall$ and $\exists$.

(2) Formation Rules:

Where $n$ and $i$ are any positive integers:
(i) For any predicate $G^n$ and any terms $a_1 \ldots a_n$: $G^n a_1 \ldots a_n$ is a wff.
(ii) For any modifier $M_n$, any predicate $G^n$, and any terms $a_1 \ldots a_n$: $M_n G^n(a_1 \ldots a_n)$ is a wff. (For any modifier $M_n$ and any predicate $G^n$, $M_n G^n$ is a non-core predicate of arity $n$.)

(iii) For any expanding predicate modifier $M_{n+1}^n$, any core predicate $G^n$, and any terms $a_1 \ldots a_n$ and $b_1 \ldots b_i$: $M_{n+1}^n[G^n(a_1 \ldots a_n)](b_1 \ldots b_i)$ is a wff. (For any modifier $M_{n+1}^n$ and any predicate $G^n$, $M_{n+1}^n G^n$ is a non-core predicate of arity $n + i$.)

(iv) For any wffs $\alpha$ and $\beta$ and any variable $x$: $\neg \alpha$, $\alpha \to \beta$, $\forall x \alpha$, and $\exists x \alpha$ are wffs.

(v) Nothing else is a wff.

(3) Axiom Schemas, Quantification Theory and Rules of Inference:

These are simply the axioms of standard predicate logic with identity.

Where $\alpha$, $\beta$, and $\gamma$ are wffs, any wffs following these schemas are axioms:

$[PL1] \alpha \to (\beta \to \alpha)$.

$[PL2] \alpha \to (\beta \to \gamma) \to ((\alpha \to \beta) \to (\alpha \to \gamma))$.

$[PL3] (\neg \beta \to \neg \alpha) \to ((\neg \beta \to \alpha) \to \beta)$.

$[Def \exists x] \exists x \alpha \equiv \neg \forall x \neg \alpha$.

$[\forall 1]$ If $x$ and $y$ are any variables and $\alpha[y/x]$ is $\alpha$ with free $y$ replacing every free $x$, $\forall x \alpha \to \alpha[y/x]$.

$[\forall 2]$ If $\vdash (\alpha \to \beta)$ and $x$ is not free in $\alpha$, then $\vdash (\alpha \to \forall x \beta)$.

$[= 1]$ $x = x$ for any variable $x$.

$[= 2]$ If $\alpha$ and $\beta$ differ only in that $\alpha$ has $x$ free in as many places as $\beta$ has $y$ free, $x = y \to (\alpha \to \beta)$.

$[Modus Ponens]$ If $\vdash \alpha$ and $\alpha \to \beta$, then $\vdash \beta$.

$[Universal Generalization]$ If $\vdash \alpha$, then $\vdash \forall x \alpha$ for any variable $x$.

(4) Formal Semantics:

We have some options for choosing the formal semantics for (SPL) with modifiers, none are uncontroversial, and the project deserves more space and consideration than
available here. We are partly stymied by more general difficulties in formalizing non-
standard modifiers. One treatment (below) gives homophonic clauses for the modi-
fiers.\(^1\) The principle defect of a homophonic semantics is the loss of compositionality.
We might also give an intensional theory of tense modifiers, defining them using a
notion of truth or satisfaction of a sequence at a time, though for obvious reasons
this would be counterproductive for the metaphysical ambitions of this project. There
may be other options depending on the predicate functors available in the logic. And
decisions about the formal semantics may likewise affect how we adjudicate between
Options 1 and 2 (expander and simple tense modifiers). I plan to pursue alternatives
in future work. For now, a sketch of a homophonic strategy:

A model \(M\) is an ordered pair \(\langle D, V \rangle\) where \(D\) is a non-empty set, and \(V\)
is an interpretation function that assigns subsets \(D_n\) to \(n\)-place predicates in any wff. A wff \(\alpha\) is true in a model \(M\) if and only if \(V_\mu(\alpha) = 1\) on each variable assignment for \(M\). A wff \(\alpha\) is valid if it is true on all models. Where \(\mu\) is an assignment, \(G^n\) any predicate and \(M^n_n\) and \(M^n_{n+i}\) any simple and expander modifiers:

\[
\begin{align*}
[VG^n] & \quad V_\mu(G^n(a_1 \ldots a_n)) = 1 \text{ if } \langle \mu(a_1) \ldots \mu(a_n) \rangle \in V(G^n) \text{ and } 0 \text{ otherwise.} \\
[VM^n_n] & \quad V_\mu(M^n(G^n(a_1 \ldots a_n))) = 1 \text{ if } \langle \mu(a_1) \ldots \mu(a_n) \rangle \in V(M^n G^n) \text{ and } 0 \text{ otherwise.} \\
[VM^n_{n+i}] & \quad V_\mu((M^n_{n+i} G^n(a_1 \ldots a_n)(b_1 \ldots b_i))) = 1 \text{ if } \\
& \quad \langle \mu(a_1) \ldots \mu(a_n) \ldots \mu(b_1) \ldots \mu(b_i) \rangle \in V(M^n_{n+i} G^n) \text{ and } 0 \text{ otherwise.} \\
[V =] & \quad V_\mu(x = y) = 1 \text{ if } \mu(x) = \mu(y) \text{ and } 0 \text{ otherwise.} \\
[V \neg] & \quad V_\mu(\neg \alpha) = 1 \text{ if } V_\mu(\alpha) = 0 \text{ and } 0 \text{ otherwise.} \\
[V \rightarrow] & \quad V_\mu(\alpha \rightarrow \beta) = 1 \text{ if } V_\mu(\alpha) = 0 \text{ or } V_\mu(\beta) = 1 \text{ and } 0 \text{ otherwise.} \\
[V \forall] & \quad V_\mu(\forall x \alpha) = 1 \text{ if } V_\rho(\alpha) = 1 \text{ for all } x \text{-alternatives } \rho \text{ of } \mu \in D \text{ and } 0 \text{ otherwise.} \quad (\text{Where an } \text{“} x \text{-alternative of } \mu \text{”} \text{ is identical to } \mu \text{ except at most in uniformly assigning a different member of the domain to the free variable(s) in } \alpha \text{ than } \mu \text{ does).}
\end{align*}
\]

\(^1\)Peacocke (1976) gives much more detailed work toward a homophonic theory for “necessarily.” His semantics allows embedded modifiers.
Appendix B

Suggested Postulates for Operator-Free A-Theory

This second appendix is even more speculative. I think the proposed metaphysics combined with a few fairly general postulates can recover some of the metaphysically attractive features of standard tense logics. For example, using simple tense modifiers, we can give a postulate for the flow of time thesis—the common A-theoretic view that one time is “special” and that times change with respect to being the present:

\[
\text{A-THEORY FLOW OF TIME: There is some time } t \text{ and some property } C, \text{ such that } t \text{ has } C \text{ only temporarily and it is the only time that has } C. \text{ In the formalism already introduced: } \exists t_1 \exists C^n(C^n(t_1) \land (\neg P^n_C^n(t_1) \land \neg F^n_C^n(t_1)) \land \forall t_2(C^n(t_2) \rightarrow (t_1 = t_2))).
\]

We then define the flow of time in virtue of whatever that special property \( C \) is—maybe is the time that contains objects with temporary properties.

Additionally, propositional temporalists can formulate some attractive generalizations about the relations between propositions and the rest of the world. Where \( \varphi \) is any sentence (any wff with no free variables) and ‘\( \varphi \)’ is the proposition that \( \varphi \):

\[
(P1): \forall x \forall \varphi \forall t(P^n_{n+1}[\varphi](t) \leftrightarrow P_2^1[T^{1\Gamma} \varphi\neg](t))
\]

Ex: Bush was President in 2005 if and only if the proposition that Bush is President was true in 2005.

\[
(P2) \forall x \forall \varphi \forall t(F^n_{n+1}[\varphi](t) \leftrightarrow F_2^1[T^{1\Gamma} \varphi\neg](t))
\]

Ex: Mary will be President in 2030 if and only if the proposition that Mary is President will be true in 2030.
(P3) $\forall \varphi (T_1^\gamma \varphi \rightarrow \exists t_1 (P_2^l [T_1^\gamma \exists t_2 [F_2^l T_1^\gamma \varphi](t_2)](t_1)))$

This is the analogue of the $\varphi \rightarrow PF \varphi$ axiom in tense logic system K.

(P4) $\forall \varphi (T_1^\gamma \varphi \rightarrow \exists t_1 (F_2^l [T_1^\gamma \exists t_2 T_1^l [P_2^l T_1^\gamma \varphi](t_2)](t_1)))$

This is the analogue of the $\varphi \rightarrow FP \varphi$ axiom in system K.

(P5) $\forall \varphi \forall \phi (\forall t P_2^l [T_1^\gamma \varphi \rightarrow \phi](t) \rightarrow (\forall t P_2^l [T_1^\gamma \varphi](t) \rightarrow \forall t P_2^l [T_1^\gamma \phi](t)))$

This is the analogue of the $H(\varphi \rightarrow \phi) \rightarrow (H(\varphi) \rightarrow H(\phi))$ axiom in system K.

(P6) $\forall \varphi \forall \phi (\forall t F_2^l [T_1^\gamma \varphi \rightarrow \phi](t) \rightarrow (\forall t F_2^l [T_1^\gamma \varphi](t) \rightarrow \forall t F_2^l [T_1^\gamma \phi](t)))$

This is the analogue of the $G(\varphi \rightarrow \phi) \rightarrow (G(\varphi) \rightarrow G(\phi))$ axiom in system K.

We can capture the patterns formalized in stronger tense logics using the same translation procedure, though these are no longer pure theorems of the logic.
Bibliography


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