Powers presentism

**Abstract** This paper argues: first, that a presentist, powers based, diachronic account of modality can provide a satisfactory account of our intuitions about modality as well as a compelling rebuttal to alternative accounts; second that taking this account seriously requires a more radically attenuated modal logic than even partisans of such an account realize. Attempting to navigate this problem, I provide a formal, non-normal semantics for a tensed modal logic, along with a philosophical interpretation of it.

Keywords: Presentism; eternalism; powers; modality; truthmaking; future contingents; substructural semantics.

# 1 Introduction

This paper combines dispositionalist modality and presentist philosophy of time into a unified account solving the problems each faces on its own. Powers modality has begun to split into two camps: the one focusing on *synchronic* modality; the other, on *diachronic* modality. Adherents to the synchronic approach include Gabriele Contessa, David Yates, and others; diachronic approaches were first advocated in recent times by E. J. Lowe, and have been defended at length by Barbara Vetter.[[1]](#endnote-1)

The default position of synchronic modalists[[2]](#endnote-2) is *powers eternalism* – briefly, that i) modal truths are made true by the powers of actually existing things, and ii) that the scope of ‘actually existing’ includes past, present, and future objects.

In what follows, I explain why a presentist account of time provides the best of all possible homes for a powers theory of modality. I begin by recounting a powers account of modality is meant to explain. Next, I show that an eternalist powers theory is intrinsically incapable of accounting for this data. After this, I introduce powers presentism, beginning with a statement of the position, moving to its difficulties, and lastly providing a semantics and philosophical interpretation of it.

# 2 Powers eternalism

## 2.1 The place of powers modality

Today, powers approaches to modality are among the most visible forms of actualism.[[3]](#endnote-3) According to powers theorists, modal ascriptions “wear their truth-conditions very much on their sleeves: they are true just in case ... [existing objects] have certain properties – abilities, capacities, powers, dispositions – and that’s all there is to it.”[[4]](#endnote-4) A state of affairs <*p*> is possible if there is a power to bring it about that <*p*>; and conversely, a state of affairs is necessary if there is no power to bring about <¬*p*>. In David Yates’ notation:

♢*p* ≝ (∃Φ)⟩[*p*](Φ)

□*p* ≝ ¬(∃Φ)⟩[¬*p*](Φ)[[5]](#endnote-5)

It is natural to think of powers as belonging to particular objects. And so, for instance, the above definition of possibility would admit the following expansion:

♢*p* ≝ (∃*x*)(∃Φ)(Φ(*x*) & ⟩[*p*](Φ))

with the caveat that plurals may be substituted for both ‘*x*’ and ‘Φ’, as needed.[[6]](#endnote-6)

Now one might ask, “What is the range of the quantifiers in the above formulae?” Though seldom explicitly addressed, one of the following answers is standardly assumed:

1. all present objects and properties.
2. all past and present objects and properties.
3. all past, present, and future objects and properties.

The first option is presupposed in Vetter’s account of possibility;[[7]](#endnote-7) the second, by the accounts of Jacobs[[8]](#endnote-8) and Simchen;[[9]](#endnote-9) the third, by those of Pruss,[[10]](#endnote-10) Borghini and Williams,[[11]](#endnote-11) and Yates.[[12]](#endnote-12) Advocates of the first two options standardly approach modality diachronically; of the third, synchronically.

## 2.2 The material inadequacy of powers eternalism

Let us, then, assume that a state of affairs <*p*> is possible iff there is, was, or will be some power Φ to bring about <*p*>. From this the material inadequacy of tenselessly actualist dispositionalist modality can easily be shown on two straightforward assumptions: (1) powers explain generation and corruption, i.e. things and their properties coming into and passing out of existence; and (2), dispositionalist modality, in contrast with both ‘softcore’ actualism and possibilism, need not appeal to possible worlds at all in explaining modality, regardless of how these are understood.[[13]](#endnote-13)

Given the adoption of eternalism, first-order quantification over objects and second-order quantification over powers ranges over all the powers and objects, there ever are, were, or will be. But given the second point above, any new objects that could be generated would have to be generated someplace within the actual spatiotemporal manifold. Assume some such object is generated. Then it comes from non-being into being, i.e. from not within to within the range of quantification. But given eternalist quantification, that object is already within the range of our quantifiers to begin with. Contradiction. The same point holds, *ceteris paribus*, for powers and properties.

To state the point more broadly. The primary data a powers theory of modality is supposed to account for is the coming into being and the passing away of objects and their properties: *possibilia* are *generabilia*: possible states of affairs are states that can be brought into being; possible objects, objects that can be generated. Any modal logic grounded in powers must, at minimum, be compatible with this point. But if we take the range of our first-order quantifiers to be a world as a completed totality, then we find ourselves unable to use the quantificational machinery to explain substantial generation: everything is already there, and so there is no power to bring about the existence of something not already within the scope of our quantifiers; nothing ever moves from being outside the scope of quantification to being within it (or vice versa). For parallel reasons, if we do the same with our second-order quantifiers,[[14]](#endnote-14) we can’t explain accidental generation or corruption, either. And so, powers eternalism turns out to be useless as a theory of modality.[[15]](#endnote-15)

## 2.3 A short note on growing-block dispositionalism

What we are left with, then, are two different diachronic approaches to modality: the one, presentist; the other, growing-block. I have no wish to refute growing-block powers accounts; and I think, now that their existence has been pointed out, their authors can provide interesting results on these theories.[[16]](#endnote-16) I wish here only to make a few technical remarks.

First, a growing block theory is one on which the domain of quantification increases monotonically over time. Assuming we treat properties and objects even-handedly, the number of properties can only increase on a growing block theory, which entails that the number of powers can only increase. If, as is natural, we take diachronic modalities to be forward-looking – i.e. the presence of a modal formula at an earlier time is cashed out by its non-modal equivalent at a later time – then any power within the range of second-order quantification at an earlier time remains so at each later time, i.e.

♢*ϕ* ⊃ □♢*ϕ*

This, in turn, places restrictions on what the objects and properties involved in *ϕ* are allowed to be: for instance, Michael Phelps is an Olympic gold medal swimmer. And so, given that Phelps *has* won gold medals, one could in the past to say of him that he can win a gold medal. But Phelps will not always be able to win gold. He won’t be able to when he’s old, and he won’t be able to after he’s dead. But because the object denoted by ‘Michael Phelps’ can cease to exist, it can’t be the kind of thing allowed into the growing block dispositionalist’s domain of quantification. For similar reasons, the ability to win Olympic gold cannot be countenanced as a genuine power. Rather, one would have to time-index such objects and qualities, or find some other suitable fix.[[17]](#endnote-17)

# 3 Introducing powers presentism

To begin, it should be useful for us to reflect on what being a presentist means. Historically, presentist accounts like Prior’s were motivated as better capturing the way time is experienced. The eternalist picture, thinks the presentist, cannot account for our experience of the passage of time, nor for the privileged status we accord to the present moment.[[18]](#endnote-18) Such theories may be thought of as theories of a *privileged* present. Current theories of presentism, by contrast, tend to be summed up in the claim that *only* the present exists. Call theories of this sort ‘theories of the *lonely* present’.

Presentism has come under fire as being unable to provide a satisfactory account of truths about the past. Briefly, presentists believe that only the present exists, and most also believe that a) there are truths about the past, and b) that (at least some) past truths require truthmakers, i.e. objects within an ontology that make true propositions so. The problem this poses is that assuming only present objects exist, the presentist must account for the truth of past-tensed statements solely in terms of these; and so, either the presentist will not be able to account for past truths, or will only account for them in an *ad hoc* manner, thereby undermining the ontological parsimony that helped make presentism appealing in the first place. This has led to a rift between those Tallant and Ingram call *upstanding presentists,* on the one hand, and *nefarious presentists,* on the other.[[19]](#endnote-19) Upstanding presentists attempt to provide present truthmakers for past truths. Nefarious presentists like Tallant and Ingram think they can get away without doing so.[[20]](#endnote-20)

The difference between lonely presentism and Prior’s, if I may put it this way, is that the lonely presentists’ aims are what I should call “onto-semantic”,[[21]](#endnote-21) while those of Priorean presentism are aitio-syntactic: the former aims to determine the full range of entities in accordance with the limits of semantic permissibility; the latter, to determine the relative priority of beings in accordance with the dictates of syntactic recursion.[[22]](#endnote-22)

The presentism I advocate holds past moments are past presents, rather than present pasts;[[23]](#endnote-23) and its aims are closer to those of Prior than those of lonely presentism. To the degree that the presentist-eternalist debate is a sensible one, I should interpret it not as an *ontic* dispute about what exists, with the presumption that both parties are using ‘exists’ in the same sense; but rather as a prioritydispute about the ordering of the senses of ‘being’.[[24]](#endnote-24) Just as, for instance, ‘being’ is said in a more fundamental sense of substance than it is of accident, or of the actual than the possible, so also is it ascribed more fundamentally to the present than to that which has passed out of presence (i.e. the past) or that which is yet to come to presence (i.e. the future).[[25]](#endnote-25)

# 4 The challenge of “hardcore actualism”

Though this presentist, actualist, powers-based conception provides a thick and intuitively satisfactory theory of modality, I doubt that even those who have adopted it have yet realized how radical an effect it should have on our preferred logic. If powers modality is supposed to be “hardcore actualist”,[[26]](#endnote-26) it is not yet nearly hardcore enough. In what follows, I detail the various attenuations the powers presentist is beset by.

## 4.1 Syntactic challenges

### 4.1.1 The failure of (4), (5), and (B)

For the purposes of what follows, it will be more useful to think of (4) in terms of its possibility phrasing rather than its necessity phrasing. The axiom thus read is as follows:

(4) ♢♢*ϕ* → ♢*ϕ*

In the context of a diachronic, forward-looking account of possibility, where the objects upon which a valuation function acts are times within an ordered series, the (4) axiom may be read as saying that whatever is possible at some later time is already possible at a time prior to it; negatively stated, no new possibilities ever come into existence.[[27]](#endnote-27) But if we assume i) that beings come into and go out of existence; and ii) that powers belong to these beings: it stands to reason that certain powers will also come into and out of existence along with their bearers.[[28]](#endnote-28) If we further assume iii) that the actualization of a power takes *time*, it would be sensible to place an upper bound on the time it takes for a power to be actualized, such that the actualization of a power at time *tn*cannot count towards its availability at a time too distant from *tn*. For example, my speaking French at present does not entail that there was a power for me to speak French at age 3; even less does it entail the presence of such a power a million years prior to my existence.

For similar reasons, we can expect (5) to fail:

(5) ♢*ϕ* → □♢*ϕ*

Understood temporally, this says that whatever is possible at a time remains possible at every accessible time succeeding it. But as stated earlier, possibilities can cease to be, e.g. in cases when the objects or properties grounding them cease to exist.

Lastly, we can construct a similar counterexample to (B) as follows:

(B) *ϕ* → □♢*ϕ*

Let *ϕ* itself be tensed, as in ‘I’ve never been to Venice’ – true at the time of my writing. But it is not the case that in every possible future this situation remains possible: I could visit Venice, after which point it will be impossible for me not to have done so.

### 4.1.2 (T), (D), and beginning and ending time

The modal logic axiom (T) can be formulated in the following two equivalent ways:

(T1) *ϕ* → ♢*ϕ*

(T2)□ *ϕ* → *ϕ*

In its first formulation, the formula admits of clear counterexamples. Assume Pheidippidesis running a marathon, and let the present time be a moment of intense fatigue where Pheidippidesis running but simply cannot go on any longer. Making a different use of the previous example, we can see that ‘Pheidippides must stop running’ holds before he is actually stopped.

There is, however, a plausible situation where a more limited version of (T) may be admitted. Suppose □*ϕ* is a necessary truth not merely at present, but one of such a nature as to be so at every moment, e.g. “Necessarily, every star emits light and heat.” Let us call the set of past moments along with the present one *enacted* times. In this case, if □*ϕ* is true in every enacted time, then one can find a world preceding the present one where it is also true, hence a world where in each of its immediately possible futures *ϕ* is true. Since the actual present is one such future, *ϕ* will also be true in this case.

There is a caveat to the previous point. The above analysis assumes necessary truths ground their later, assertoric counterparts: it is not because something is true in every accessible future that it is necessary; rather, it is on account of its necessity that it is true in every accessible future.[[29]](#endnote-29) But this holds in full generality for enacted times only if it’s possible to assume seriality for pastness, i.e. that for any enacted moment, there is another prior to it.[[30]](#endnote-30) To see this, assume there is a first moment in time, □*ϕ* holds there, and that □*ϕ* is itself what one might call an eternal truth, something of such a nature as to hold at each and every moment. Now at this first moment, *ϕ* may hold, but its doing so cannot be on account of □*ϕ* holding, since the eternal truth of □*ϕ* at a moment only indirectly secures the truth of *ϕ* at that same moment, i.e. by □*ϕ*’s holding at a previous moment accessing the current one. Whether there always is such a moment seems to be an empirical question. However, one might motivate adopting the claim

(T’) If in every enacted time □*ϕ*, then in every enacted time, *ϕ*

heuristically, from an interest relative standpoint: when we reason about modality, we usually aren’t interested in situations where the beginninglessness of the past has any bearing on the matter at hand; so we bracket out these cases, leaving models where it *does* have a bearing outside of those considered. There doesn’t seem to be anything wrong with adopting (T’), provided one recognizes the empirical caveats involved in doing so.

The axiom (D) reads:

(D) □*ϕ* → ♢*ϕ*

The axiom states that necessity entails possibility. Syntactically, the axiom accords with a pre-theoretic account of diachronic powers modality: if something *must* happen, then surely it can happen. The semantic effect of the axiom is to rule out necessities that hold vacuously, i.e. by virtue of there being no moments accessible from that at which the necessity is evaluated. In particular, it serves to rule out models where both a proposition and its contradictory opposite hold necessarily. In the temporal, diachronic context, it serves to rule out models where the set of enacted times, including the present time, includes the *last* moment in time. As in the previous case, I don’t think this can be motivated from a strictly empirical perspective. But heuristic bracketing of these abnormal cases, and exclusion of models allowing them, makes much sense.

## 4.2 Semantic challenges

The basic account of modality the powers presentist starts with is quite weak, and most characteristic axioms of various normal modal logics fail for it.[[31]](#endnote-31) On the semantic side, the machinery is greatly simplified. First, the notion of a possible world plays no important role in our understanding of modality: hence, they do not show up in our semantics.

Perhaps more surprisingly, powers presentism does away with the need for a history parameter for evaluating tensed and modal propositions. Most tensed modal logics have recourse to a *history* or *chronicle* parameter, used to determine the truth of various modal sentences. In these sorts of models, the truth of a formula is valuated relative to both a moment *m and* a history *h* going through that moment; and a sentence □*ϕ* is evaluated as true, for instance, provided *ϕ* is true at *m* in every alternative history *h’* going through *m*.[[32]](#endnote-32) There are a few reasons why this kind of account is rejected. First, the modal here is synchronic, and we argued above that though there is nothing inherently wrong with synchronic modality, it doesn’t play the fundamental role diachronic modals do. Second, the history parameter effectively smuggles possible worlds in through the back door. Histories or chronicles are maximal linearly ordered subsets of the set of moments, intuitively corresponding to entire courses of history from beginning to end. But these are, arguably, just what is usually meant by possible worlds. And since worlds play no real role in our understanding of modality, neither will histories. As we shall see, diachronic possibility can do without histories.[[33]](#endnote-33)

# 5 Semantics for powers presentism

## 5.1 Semantics

In what follows, I introduce a basic first-order modal tense semantics to outline how the ideas outlined above might be realized. Our base language ℒ = (**C, Q, Pr, Trm, Frm**), where **C** = {~, &, v, ⇒, (, ), □, ♢, ℱ, ℋ, 𝒫}, **Q** = {∀, ∃}, **Pr** is a set of predicates, **Trm** = **Con** ⋃ **Var** is our set of terms, where **Con** is a set of constants {*a, b, c, d,* …,} and **Var** is our collection of variables. **Frm** is our set of well-formed formulae, membership in which is defined in the usual way.[[34]](#endnote-34) Intuitively, ℱ is a future tense operator (‘It will be the case that’), while ℋ and 𝒫 are past tense analogues of □ and ♢, respectively. We take all constants to designate rigidly,[[35]](#endnote-35) and restrict our exposition to monadic predicates, though the extension to polyadic predicates is straightforward.

The semantics combines elements of Lemmon’s *S0.5* and Lukasiewicz’s 3-valued system with the weak negation operator of Bochvar’s external three-valued logic, while adding tense and modal operators.[[36]](#endnote-36) We let *M* = (*S*ℒ*, T*, @, *R,* *L*, *v*) be a variable domain first-order model. *S*ℒ= (𝔻, 𝒱,𝒟, {*fc:c*∈**C**}, {*fq: q*∈**Q**}) is a structure for a many-valued logic, where 𝔻 the domain of the model; our set of truth values 𝒱 *=* {0, ½, 1}, with the expected ordering on its elements; 𝒟 = {1} is our set of designated values, and the members of *fc* and *fq* are functions denoted by our sentential connectives and quantifiers, respectively. *T* = {*t0, t1, t2…tn*} is a set of times, @ is a privileged member of *T*. Intuitively, @ is the actual time, while the members of *T* - @ are non-actual times. *R* is a serial, irreflexive, intransitive binary relation on *T*, which will govern the semantics of □, ♢, and ℱ; while *L* is an irreflexive, transitive, linear and connected binary relation on *T* – intuitively, the *later than* relation – governing the semantics of ℋ and 𝒫. Lastly, *v* is an assignment function mapping: each time *t* to subsets of 𝔻, written as 𝔻(*t*); pairs of times *t* and terms to objects in 𝔻(*t*)for each time *t*; and pairs of the form (*t, P*), where *P* is any predicate, to functions from 𝔻 to 𝒱. As examples, we write the second function as *vt*(*c*), the third as *vt*(*P*), and the resulting valuations of atomic formulae as *vt*(*Pc*). We use ‘*Min*’to pick out the lowest in a set of truth values, and ‘*Max*’ for the highest in a set.

We place the following constraints on the assignments of constants and predicates:

1. For any constant *c*,time *t*, and object *d*,if *vt*(*c*) = *d*, then *d* ∈ 𝔻(*t*)
2. For any time *t* and object *d* in 𝔻(*t*), ∃!*c*: *c* ∈ **Con** and *vt*(*c*)=*d*
3. For any time *t* and atomic formula *Pa*, *vt*(*a*) ∈ 𝔻(*t*)iff *vt*(*Pa*) ∈ {0, 1}. Otherwise, *vt*(*Pa*) = ½.

For reasons which will become apparent in our philosophical exposition of the semantics, we add the following condition:

1. For any constant *c* and times *t, t’,* if *vt*(*c*) = *vt’*(*c*), then for all *t’’* such that *tLt’’Lt’, vt’’*(*c*) = *vt*(*c*) = *vt’*(*c*).

The first condition states that only objects in the domain of a time are named there; the second, that every object in the domain of a time has exactly one name at that time; the third, that atomic formulae are true or false for all and only objects existing at that time, i.e. indeterminacy occurs at the atomic level for all and only non-existent objects. The fourth prevents ‘gappy’ designation.

Lastly, we place the following constraint on the relations *L* and *R*:

1. For any times *t, t’*, if *tRt’*,then *t’Lt*.

For reasons that we will make clear, the converse of (v), however, will not generally hold.

The semantics for ~, &, →, and v are as follows:

(~) *vt*(~*ϕ*) = 1 iff *v*t(*ϕ*) ≠ 1, and 0 otherwise.

(&) *v*t(*ϕ* & *ψ*) = *Min*(*vt*(*ϕ*), *vt*(*ψ*)).

(v) *vt*(*ϕ* v *ψ*) = *Max*(*vt*(*ϕ*), *vt*(*ψ*))

(→) *vt*(*ϕ* → *ψ*) = 1 – *vt*(*ϕ*) + *vt*(*ψ*)

For ℋ and 𝒫:

(ℋ) *vt*(ℋ*ϕ*) = *Min*(*vt’*(*ϕ*): *tLt’*).

(𝒫) *vt*(𝒫*ϕ*) = *Max*(*vt’*(*ϕ*): *tLt’*).

We give the following semantics for □, ♢, and ℱ:

(□) For any formula *ϕ* and time *t*, if *t =* @ or @*Lt*, then *vt*(□*ϕ*) = *Min*(*vt’*(*ϕ*): *tRt’*). If this precondition is not met, then *vt*(□*ϕ*) = ½.

(♢) For any formula *ϕ* and time *t*, if *t = @* or *@Lt*, then *vt*(♢*ϕ*) = *Max*(*vt’*(*ϕ*): *tRt’*), where *t’*∉ {@} ⋃ {*t: @Lt*}.[[37]](#endnote-37) Otherwise, *vt*(♢*ϕ*) = ½.

(ℱ) For any formula *ϕ* and time *t*, if *t* = @ or @*Lt*, then *v*t(ℱ*ϕ*) = 1 iff for every t’ such that t*R*t’, *v*t’(*ϕ*) = 1; 0 iff for every t' such that t*R*t', *vt'*(*ϕ*)=0; Otherwise, *v*t(ℱ*ϕ*)=½.[[38]](#endnote-38)

Lastly, the clauses for quantifiers are the following. For any formula *ϕ*, time *t,* constant *c* and variable *u*:

(∃) *vt*((∃*u*)*ϕ*) = *Max*(*v*(*ϕ*[*u*/*cd: d* ∈ 𝔻(*t*)]), where *ϕ*[*u*/*cd: d* ∈ 𝔻(*t*)] is the result of taking each free instance of *u* in *ϕ* and replacing it with each constant *c* s. t. *v*(*c*) ∈ 𝔻(*t*).

(∀) *vt*((∀*u*)*ϕ*) = *Min*(*v*(*ϕ*[*u/cd*: *d* ∈ 𝔻(*t*)]).

An argument from a premise set Γ to a proposition *ψ*, is a *valid ut nunc* consequence, written Γ ⊨@ *ψ* iff for every model, for every time *t* in {@ ⋃ {*t: @Lt*}}where for all propositions *ϕ1*, …, *ϕn,* in Γ, *vt*(*ϕ­1*) = … = *vt*(*ϕn*) = 1, it is also the case that *vt*(*ψ*) = 1; and the same consequence is *valid simply*, written Γ ⊨*S* *ψ*, iff for every model where *vt*(*ϕ­1*) = … = *vt*(*ϕn*) = 1 at every time *t* in {@ ⋃ {*t: @Lt*}}, it is also the case that *vt*(*ψ*) = 1 for each *t* in {@ ⋃ {*t: @Lt*}}.

Call a model containing all the elements of @ ⋃ {*t: @Lt*}, where i) the later-than relation as well as the values of atomic formulae at the above times remain fixed at their actual value, that ii) possibly extends this set forward, an @-*model*. We say that *ψ* is *true* iff *v@*(*ψ*) = 1in every @-model.

## 5.2 Interpretation

We begin our philosophical explication of this construction by giving a non-standard, decidedly metaphysical interpretation of the semantics for ℒ. We let our constants denote *designated matter*, and we interpret those constants themselves as *substantial forms*. So, for instance, *vt0*(*a*)=∂*a* means that the substantial form *a* is instantiated in the matter ∂*a* at *t0*.[[39]](#endnote-39) Similarly, we interpret our monadic predicates as *accidental forms* instantiated in the matter designated by our terms, and specifically as forms belonging to the Aristotelian categories of *quality* and *quantity*.[[40]](#endnote-40) Propositions are taken to denote states of affairs. We interpret the semantic value 1 as *actuality*; 0 as the determinately non-actual; and ½ as objectively indeterminate.

Against this backdrop, the constraints on the assignments of constants amount to the following. The first requires that substantial forms, if they are instantiated at all, are instantiated in existing matter. The second denies the Medieval Franciscan thesis that a *plurality* of substantial forms can be instantiated in the same matter simultaneously. The third states that accidents are only instantiated in existing beings. The fourth requires that the times at which an individual substantial form is instantiated be connected to each other. The intuition behind this restriction is best seen in the case of biological entities. Living beings belonging to a natural kind don’t exist intermittently: they come into being, live their lives, and then die – i.e. they lose the form that provides them with their characteristic manner of being.

The *L* relation on times is interpreted as the *later than* relation. But the semantics – and, as I will argue, the metaphysics it is meant to express – does not permit it to be interpreted as the converse of the *earlier than* relation. Rather, we will say that if *tnRtk,* then the time *tk* is *realizable* by the time *tn.* In this way, for the state of affairs constituting a time to be a *possible* time is just for it to be grounded in the potencies of one immediately preceding it;[[41]](#endnote-41) and conversely, a time that is actual, so long as it is so, is itself a subject of potencies. This gives us our two conditions on *R*: *R* is serial because a state of affairs at a given time must be able to realize *some* state of affairs; and *R* is intransitive because not every state of affairs realizable by a previous one is also realizable by one prior to that one.[[42]](#endnote-42) Within our semantics, future worlds are treated as *non-normal*. What should we make of this?

## 5.3 The Present and the Future

To the degree that they are addressed in the literature, the dominant philosophical interpretation of non-normal worlds is as *im*possible worlds: worlds where the laws of logic may fail.[[43]](#endnote-43) But our analysis allows for a different take. The main distinction in the semantics between normal and non-normal times is that at non-normal times, all future-oriented modal formulae take value ½; while at normal – i.e. actualized – times, they may take other semantic values as well. As such, these elements cannot be interpreted, in Lewisian fashion, as “ways things could have been”[[44]](#endnote-44), since if they *had* been, they would treat modal formulae differently; nor can they be treated as *im*possible, inasmuch as *R* has been interpreted as a realizability relation, while impossible worlds would be unrealizable in principle.

Rather, we treat these times as *merely* possible. We name four advantages of this interpretation.

First, it allows us to reinterpret talk about what holds at merely possible moments as talk about the potentialities of those moments by which they are realizable, thereby establishing the derivative character of such talk, and therefore the derivative character of the *being* accorded to these moments.[[45]](#endnote-45)

Second, it provides us with a necessary condition for the *existence* of a time: to be is to be a subject of potencies. Since ♢-formulae are all indeterminate at merely possible worlds, such worlds don’t exist.[[46]](#endnote-46)

Third, it provides us with a criterion for the *identity* of two times, along with a way of distinguishing different criteria for identity. We will say that times are *formally* identical if they agree on the valuations of all *atomic* formulae; that they are identical in *origin* if, in addition, they agree on all past-tense formulae; and they are *materially* identical if they agree on *all* formulae. This allows us to show that, on the one hand, there is a genuine sense in which actualized worlds are the same as their merely possible correlatives; and on the other, that *coming into being*, and thereby being located within a history, makes a palatable difference *even if* ‘exists’ isn’t a real predicate.[[47]](#endnote-47)

Finally, interpreting ℱ in terms of a realizability relation, and thus in terms of potencies of what is, provides us with a principled reason for the distinction between the future and the past as represented by the image of a ‘branching’ future: most of our statements about what will be are not, at least in the straightforward sense, about the future at all. Rather, they are about what, at present, is ‘in the works’– i.e. what a state of affairs that *is* given as present forbodes or suggests about what is to come.[[48]](#endnote-48) This understanding of the future tense was already present in Aristotle;[[49]](#endnote-49) however, the point has not been appreciated in discussions of tense, and – as far as to my knowledge, no formal work has been done on this altogether common sense futurity. Calvin Normore, drawing on Pseudo-Scotus,[[50]](#endnote-50) explains the point thus:

If you, seeing someone advance against the light in a busy intersection, say ‘there is going to be an accident’, you are not making a simple prediction but are saying something else – namely, that the causes of the accident are in place.[[51]](#endnote-51)

In this way, the asymmetry between past and future is grounded in a deeper asymmetry between the way the past and future ‘are’: the existence of the future is an existence *in ovo* in its present causes, and therefore given in and mediated by the present.

# 6 Conclusion

We began our discussion by showing that presentist approaches to modality have begun to split into two camps: one eternalist, focusing on synchronic modality; the other presentist, focused on diachronic modality. After showing the eternalist account unable to explain the primary data of powers modality – namely, generation and corruption – we introduced powers presentism. Though not beset by the inadequacy problem rocking eternalist accounts, a strong, presentist powers theory of modality forces the abandonment of many of the axioms characteristic of different normal modal logics: powers presentist modalities are made accurate, if not perfect, in weakness. Our philosophical interpretation of powers presentist semantics then provided us with a new interpretation of non-normal worlds, which then allowed the formulation of distinct criteria for identity of times, and a principled account of the asymmetry of the past and future.

The above does not solve the difficulties involved in this account, nor does it gloss them over. But as Kripke put it in a different context, the development of an adequate theory involves an element of *risk*. And powers presentism is a theory worth risking.

# References

Any abbreviations used in text are found in brackets after the corresponding entry.

Aquinas, Thomas (1888). *Summa Theologiae*. Cited by part, question, article, and section. Available online at <http://www.corpusthomisticum.org/sth1015.html>. [*ST*].

(1950). *Sententia Libri Metaphysicae*. Cited by book, lecture, and section. Available online at <http://www.corpusthomisticum.org/cmp00.html>. [*In Metaph.*]

(1955). *In Libros Peri Hermeneias Expositio*. Cited by book, lecture, and section. Available online at <http://www.corpusthomisticum.org/cpe.html>. [*DI*]

(1970). *Quaestiones Disputatae de Veritate*. Cited by question, article, and section. Available at <http://www.corpusthomisticum.org/qdv01.html> [*DV*].

Aristotle (1984a). *De Interpretatione*. Trans. E. M. Edgehill. In *The Complete Works of Aristotle, vol. 1*. ed. Jonathan Barnes. (Princeton, NJ: Princeton University Press), 25-38 [*Peri Her.*].

(1984b). *On Generation and Corruption*. Trans. H. H. Joachim. In *The Complete Works of Aristotle, vol. 1*. ed. Jonathan Barnes. (Princeton, NJ: Princeton University Press), 512-554 [*De Gen*.].

(1984c). *Metaphysics*. Trans. W. D. Ross. In *The Complete Works of Aristotle, vol. 2*. ed. Jonathan Barnes. (Princeton, NJ: Princeton University Press), 1552-1728 [*Metaph*.].

Baron, S. (2013). “Talking About the Past”, *Erkenntnis* 78, 547-560.

(2015). The Priority of the Now”, *Pacific Philosophical Quarterly* 96, 325-348.

Beall, J. C. (2000). “Fitch’s Proof, Verificationism, and the Knower Paradox” *Australasian Journal of Philosophy* 78, 241-247.

Besson, Corine, and Anandi Hattiangadi (2014). “The Open Future, Bivalence, and Assertion” *Philosophical Studies* 167:2, 251-71.

Bigelow, John (1996). “Presentism and Properties”, in *Philosophical Perspectives* 10,

Bird, Alexander (1998). “Dispositions and Antidotes” *Philosophical Quarterly* 48, 227-234.

(2007). *Nature’s Metaphysics: Laws and Properties* (Oxford: Oxford University Press).

Bobzien, Susanne (2011). “Dialectical School” *Stanford Encyclopedia of Philosophy*, Edward N. Zalta (ed.). URL = <http://plato.stanford.edu/entries/dialectical-school/>

Borghini, Andrea, and Neil E. Williams (2008). “A Dispositional Theory of Possibility” *Dialectica* 62:1, 21-41.

Bourne, Craig (2006). *A Future for Presentism* (Oxford: Oxford University Press).

Brouwer, L. E. J. (1999). “Intuitionism and Formalism” *Bulletin of the American Mathematical Society* (New Series), 37:1, 55-64.

Cameron Ross (2011). “Truthmaking for Presentists” in Karen Bennett and Dean Zimmerman (eds.) *Oxford Studies in Metaphysics*, vol. 6. (Oxford: Oxford University Press), 55-100.

Collins, Peter (2009). *Modals and Quasi-Modals in English* (Rodopi).

Contessa, Gabriele. (2010). “Modal Truthmakers and Two Varieties of Actualism”, *Synthese* 174, 341-353.

(2013). “Dispositions and interferences” *Philosophical Studies* 165, 401-419.

(2015). “Erratum to: Dispositions and interferences” *Philosophical Studies* 172, 561-562.

(forthcoming). “Only Powers can Confer Dispositions” *Philosophical Quarterly*.

Cresswell, M. J. (1972). “The world is everything that is the case” *Australasian Journal of Philosophy* 50:1, 1-13.

Crisp, Thomas (2003). “Presentism” in Michael J. Loux and Dean Zimmerman (eds.), *The Oxford Handbook of Metaphysics* (Oxford: Oxford University Press), 211-245.

Fara, Michael (2005). “Dispositions and Habituals” *Noûs* 39, 43-82.

Frege, Gottlob (1956). “The Thought: A Logical Inquiry” *Mind* 65:259, 289-311.

Hintikka, Jaakko (1964). “The Once and Future Sea Fight: Aristotle’s Discussion of Future Contingents in *De Interpretatione* IX” *The Philosophical Review* 73:4, 461-492.

Jacobs, Jonathan D. (2010). “A Powers Theory of Modality – Or, How I Learned to Stop Worrying and Reject Possible Worlds”, *Philosophical Studies* 151:2, 227-248.

Klima, Gyula (2004). “Consequences of a closed, token-based semantics: the case of John Buridan” *History and Philosophy of Logic* 25, 95-110.

(2012). “Ontological Reduction by Logical Analysis and the Primitive Vocabulary of Mentalese” *American Catholic Philosophical Quarterly* 86:3, 403-414.

Knuuttila, Simo (2011) "Medieval Commentators on Future Contingents in *De Interpretatione* 9” *Vivarium* 48, 75-95.

(2013). “Medieval Theories of Modality” *The Stanford Encyclopedia of Philosophy,* Edward N. Zalta (ed.), URL = http://plato.stanford.edu/entries/modality-medieval/

Kratzer, Angelika (1991). “Modality.” In Arnim von Stechow and Dieter Wunderlich (eds.), *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung* (de Gruyter), 639-650.

Kripke, Saul (1965). “Semantical Analysis of Modal Logic, II: Non-Normal Modal Propositional Calculi”, in J. W. Addison, L. Henkin, and A. Tarski (eds). *The Theory of Models* (Amsterdam: North-Holland), 202-220.

(1971). “Identity and Necessity” in Donald Davidson and Gilbert Harman (Eds.) *Semantics of Natural Language,* (Dordrecht: D. Ridel). Reprinted in Saul Kripke, *Philosophical Troubles: Collected Papers, Volume 1* (Oxford: Oxford University Press, 2011), 1-26. Page references are to the reprint.

(1980). *Naming and Necessity* (Cambridge: Harvard University Press).

Kvanvig, Jonathan (1995). “The Knowability Paradox and the Prospects for Anti-Realism” *Noûs* 29, 481-499.

Lewis, C. I., and C. H. Langford (1931). *Symbolic Logic* (New York: Dover).

Lewis, David (1973). *Counterfactuals* (Cambridge: Harvard University Press).

(1987). “Counterfactual dependence and time’s arrow”, plus ‘postscripts’ *Philosophical Papers* 2, 32-66.

(1997). “Finkish Dispositons” *Philosophical Quarterly*, 47, 133-151.

Lowe, E. J. (2011). “How *Not* to Think of Powers: A Deconstruction of the ‘Dispositions and Conditionals’ Debate” *The Monist* 94:1, 19-33.

MacFarlane, John (2003). “Future Contingents and Relative Truth” *Philosophical Quarterly* 53:212, 321-336.

Maier, John (forthcoming). “Dispositions and Ergativity” *Philosophical Quarterly*.

Malinowski, Grzegorz (2001). “Many-Valued Logics” in Lou Goble (ed.) *The Blackwell Guide to Philosophical Logic* (Malden: Blackwell), 309-335.

Malpass, Alex, and Jacek Wawer (2012). “A future for the thin red line” *Synthese* 188: 117-142.

Martin, C. B. (1994). “Dispositions and Conditionals” *Philosophical Quarterly* 44:1, 1-8.

Markosian, Ned (2004). A Defense of Presentism in Dean Zimmerman (ed.) *Oxford Stuies in Metaphysics*, vol. 1 (Oxford: Oxford University Press), 47-82.

McKinnon, N. and Bigelow, J. (2012). “Presentism, and Speaking of the Dead”, *Philosophical Studies* 160: 253-263.

Merricks, Trenton (2007). *Truth and Ontology* (Oxford: Oxford University Press).

Molnar, George (2003). *Powers: A Study in Metaphysics* (Oxford: Oxford University Press).

Nolan, Daniel (2015). “Noncausal Dispositions” *Noûs* 49:3, 425-439.

Normore, Calvin G. (1993). “Petrus Aureoli and His Contemporaries on Future Contingents and Excluded Middle” *Synthese* 96:1, 83-92.

Øhrstrøm, Peter and Hasle, Per (2011), "Future Contingents", The Stanford Encyclopedia of Philosophy, Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/sum2011/entries/future-contingents/>.

Palmer, Frank (1990). *Modality and the English Modals*, 2nd edition (Longman).

Peter Damian, (1972). *Lettre sur la toute-puissance divine*, ed. and trans. A Cantin (Paris: Cerf).

Priest, Graham (1992). “What is a Non-Normal World?” *Logique et Analyse* 35, 291-302.

(2008). *Introduction to Non-Classical Logic: From If to Is*. (Cambridge: Cambridge University Press).

Prior, A. N. (1959). “Thank Goodness that’s over” *Philosophy* 34, 12-17.

(1967). *Past, Present and Future*. (Oxford: Oxford University Press).

(2003a). *Papers on Time and Tense.* ed. Per Hasle, Peter Ohrstrom, Torben Brauner, and Jack Copeland. (Oxford: Oxford University Press).

(2003b). “Changes in Events and Changes in Things”, in Prior (2003a), 7-19.

(2003c). “Tense Logic and the Logic of Earlier and Later” in Prior (2003a), 117-138.

(2003d). “Now” in Prior (2003a), 171-193.

(2003e). “Tensed Propositions as Predicates” in Prior (2003a), 195-211.

Pruss (2002). “The Actual and the Possible” in R. M. Gale (Ed.), *Blackwell guide to metaphysics* (Oxford: Blackwell), 313-333.

Pseudo-Scotus (1968). *Quaestiones Octo in Duos Libros Perihermenias, Opus Secundum*. In L. Wadding (ed.), *Johannes Duns Scotus Opera Omnia*, (Hildesheim: G. Olms).

Quine, W. V. O. (1948). “On What There Is” *Review of Metaphysics* 2:5, 21-38.

Rosen, Gideon (1990). “Modal Fictionalism” *Mind* 99:395, 327-354.

Routley, Richard (1980). *Exploring Meinong’s Jungle, and Beyond* (Canberra: Research Schol of Social Sciences, Australian National University).

Sanson, David, and Ben Caplan (2010). “The Way Things Were” *Philosophy and Phenomenological Research* 81:1, 24-39.

Simchen, Ori (2006). “Actualist Essentialism and General Possibilities” *The Journal of Philosophy* 103:1, 5-26.

Stalnaker, Robert (1968). *A Theory of Conditionals*. Vol. 2 of *American Philosophical Quarterly Monograph Series* (Oxford: Blackwell), 98-112.

Tallant, Jonathan (2009). “Ontological Cheats Might Just Prosper” *Analysis* 69:3, 422-430.

(2010). “Still Cheating, Still Prospering” *Analysis* 70:3, 502-506.

Tallant, Jonathan and David Ingram (2015). “Nefarious Presentism” *Philosophical Quarterly* 65:260, 355-371.

Torrengo, Giulano (2014). “Ostrich presentism” *Philosophical Studies* 170:2, 255-276.

Vetter, Barbara (2013). “‘Can’ Without Possible Worlds” *Philosopher’s Imprint* 13:16, 1-27.

(2014). “Dispositions without Conditionals” Mind 123:489, 129-156.

(forthcoming). “From Potentiality to Possibility” to appear in *Handbook of Potentiality*, (eds.) Engelhard, K. and Quante, M., (Springer, forthcoming).

Wang, Jennifer (2015). “The Modal Limits of Dispositionalism” *Noûs* 49:3, 454-469.

Yates, David (2015) “Dispositionalism and the Modal Operators” *Philosophy and Phenomenological Research* 91:2, 411-424.

1. See Bird (2007); Contessa (2013), (2015); Yates (2015); Hauska (forthcoming); Lowe (2011); Vetter (2013), (2014). The account of Diodorean modality in Prior (1967) provides probably the first diachronic analysis of modality in post-Fregean philosophy, and several other essays in Prior (2003a) touch on the topic. Prior, however, never advocated temporal models of modality as replacements of more standard accounts. [↑](#endnote-ref-1)
2. Default because though it is seldom if ever explicitly stated, it appears to be presupposed by the quantificational practices of synchronic powers advocates. [↑](#endnote-ref-2)
3. Another form would be combinatorialism. Also, within the above diagram, I take Meinongianism to be a form of ersatzism. The best-known form of deflationism is probably Rosen’s modal fictionalism. Cf. Cresswell (1972); Routley (1980); Rosen (1990). [↑](#endnote-ref-3)
4. Vetter (2013), 1. [↑](#endnote-ref-4)
5. Here, Φ is a predicate denoting a property, and ⟩[*p*] is a predicate of <Φ>. The above equivalences constitute a position Yates calls *strong dispositionalism*. Yates contrasts strong dispositionalism with *weak dispositionalism*, for which the following equivalences hold:

   ♢*p* ≝ (∃Φ)⟩[*p*](Φ) v *p*

   □*p* ≝ ¬(∃Φ)⟩[¬*p*](Φ) & *p*

   See Yates (2015). [↑](#endnote-ref-5)
6. And so the full definition would be:

   ♢*p* ≝ (∃*x*)(∃Φ)(Φ(*x*) & ⟩[*p*](Φ)) v (∃*xx*)(∃Φ)(Φ(*xx*) & ⟩[*p*](Φ)) v (∃*x*)(∃ΦΦ)(ΦΦ(*x*) & ⟩[*p*](ΦΦ)) v (∃*xx*)(∃ΦΦ)(ΦΦ(*xx*) & ⟩[*p*](ΦΦ))

   This would be read as “there is an object (or objects) with the property Φ (or properties ΦΦ), to bring it about that <*p*>.

   The expansion of the dispositionalist definitions in terms of empowered particulars is Yates’ own; and though he officially remains neutral on the question of whether powers are instantiated in particulars, he makes use of the assumption that they are as a heuristic in his own work on the topic. [↑](#endnote-ref-6)
7. “It is possible that *p* if and only if something has (or some things have) an iterated potentiality for it to be the case that *p*.” (Vetter, (forthcoming)) [↑](#endnote-ref-7)
8. “[S]ome proposition or truth T is possible just in case there is some actually instantiated property (or property complex) that is a power for some other property (or property complex) that would be a truthmaker for T.” (Jacobs (2010), 236).

   Jacobs’ proposal, however, seems to be ambiguous between synchronic and growing-block diachronic perspectives. On the one hand, he defines the modal operators in terms of the counterfactual conditional, and the examples of alternative possibilities he brings forth are clearly intended as alternatives to the very moment at which they are not instantiated. On the other, his semantics relies heavily on the notion of a *chain*, which is interpreted as a (presumably diachronic) succession of infinitely many stages, each of which is a power to bring about the stage immediately following it. The semantics for the counterfactual conditional, in particular, assumes that a counterfactual is true at a Stage *n* iff for the nearest stage *i* to *n* at which the antecedent holds, the consequent holds at stage *i*+1. [↑](#endnote-ref-8)
9. Simchen takes ‘there might have been ϕs’ to mean that “It is possible that some plurality of things of the past, under suitable counterfactual conditions, give rise to novel instances of ϕ by way of generating them.” (Simchen (2006), 20). [↑](#endnote-ref-9)
10. “[A] non-actual state of affairs is possible if there actually was a substance capable of initiating a causal chain, perhaps non-deterministic, that could lead to a state of affairs that we claim is possible.” (Pruss (2002)). [↑](#endnote-ref-10)
11. “If the world contains some disposition such that its manifestation is the state of affairs *S*, then *S* is possible.” (Borghini and Williams (2008), 26). [↑](#endnote-ref-11)
12. “A plurality of things collectively have the power to bring it about that *p* iff there are ways of combining them such that had they been so combined, they would have produced a truthmaker for <*p*>” (Yates (2015), 413). [↑](#endnote-ref-12)
13. Cf. Contessa (2010), 341. [↑](#endnote-ref-13)
14. For reasons that we should, albeit in a different context, cf. Kripke (1972), 12. [↑](#endnote-ref-14)
15. I suspect what is occurring is the latter. For instance, though he does not say so, Yates’ dispositionalism seems to just be a disguised form of combinatorialism: powers are just those properties that can be combined in such a way as to bring about a certain state. And so, he explains powers in terms of combination, rather than countenancing the ability to be combined as merely one kind of power among others. [↑](#endnote-ref-15)
16. I say this because, with the exceptions of Vetter and Simchen, it’s not clear that powers theorists have thought much at all about the temporal presuppositions or ramifications of their theories and of the language they use to articulate them. And so, occasionally, we find these theorists using the language of a growing-block diachronic perspective interchangeably with language more appropriate to a synchronic approach. [↑](#endnote-ref-16)
17. This point is recognized by Jacobs (2010), 244. [↑](#endnote-ref-17)
18. Cf. Prior (1959); Prior (2003c). [↑](#endnote-ref-18)
19. See Tallant and Ingram (forthcoming); Torrengo (2014).

    Upstanding presentism has recently suffered two damaging critiques: the one, from Tallant and Ingram (forthcoming); the other, from Leininger (2015).

    Tallant and Ingram argue that upstanding presentists must accept that present truthmakers of whatever sort for past truths “exist *in virtue of* entities having existed”.” Given, then that “a presently existing truthmaker, *E*, is such that it exists *in virtue of* how things were, *e* [...] upstanding presentists are commited to the claim that *E* exists in virtue of *e*.” (Tallant and Ingram (forthcoming)). And given that the upstanding presentist cannot escape some relation holding between a present existent and how things were, *e*, a state that no longer exists, the positing of present truthmakers for past truths turns out to be redundant.

    Leininger characterizes presentism in terms of the following two central theses:

    *The Present Thesis.* Only the present exists: past and future moments do not exist.

    *The Change Thesis*. What is present changes: there is a difference in what exists from moment to moment. (Leininger (2015))

    The problem, says Leininger, is that the Present Thesis and the Change Thesis are incompatible: the former thesis requires an ontology of a single moment, while the latter requires that there be multiple moments available for comparison. “The presentist’s problem is that temporal change requires more than one moment; but because the presentist is limited to the existence of only the present moment, he cannot give an account of temporal change in terms of direct comparison of existing states of affairs at different moments” (ibid.).

    But the above poses a problem for nefarious presentists as well. The discourse and aims of presentism at present are set by the upstanding presentists. The goal of the presentist game is one wherein the Change Thesis is subordinated to the Present Thesis: it is the game of the lonely present. We cannot fault Tallant and other nefarious presentists for being self-professed “cheats” at a game that is in principle unwinnable (See Tallant (2009), Tallant (2010)). But we can fault them for continuing to play the game instead of moving to another table. [↑](#endnote-ref-19)
20. The rift between upstanding and nefarious presentists can be traced back *in ovo* to a remark of Prior’s from 1962:

    [T]he fact that Queen Anne has been dead for some years is not, in the strict sense of ‘about’, a fact about Queen Anne; it is not a fact about anyone or anything – it is a *general* fact. Or if it is about anything, what it is about is not Queen Anne – it is about the earth, maybe, which has rolled around the sun so many times since there was a person who was called ‘Anne’, reigned over England, etc. (It would then be a *partly* general fact – individual in so far as it concerns the earth, but irreducibly general as far as the dead queen is concerned. But if there are – as there undoubtedly are – irreducibly partly general facts, could there not be irreducibly wholly general ones?) (Prior 2003b, 19).

    In the above, Prior begins with the stance of the nefarious presentist, taking facts about the past to not be “about anyone or anything”: such facts lack truthmakers altogether. He then shifts to an account providing an alternative particular truthmaker for the proposition “Queen Anne has been dead for *n* years”, viz., the earth. Finally, he closes by suggesting there might be irreducibly general facts. But in this final suggestion, ‘general’ seems to refer not to *ungrounded* truths, but rather – as suggested by its contrast with ‘individual’ – to truths grounded in ‘Lucretian’ fashion, i.e. by the whole of presently existing reality. Both the second and third approaches are taken up by upstanding presentists: the former, for instance, by Cameron (2011) Markosian (2004), Bourne (2006), and Crisp (2007); the latter by Bigelow (1996), and McKinnon and Bigelow (2012). [↑](#endnote-ref-20)
21. The term is from Klima (2012). [↑](#endnote-ref-21)
22. This is clear from the theories with which Prior contrasted his own – for instance, in Prior (2003e), where he takes the primary contender to his own theory to be one on which tensed propositions are predicates of instances. But this, arguably, is just a generalization of the approach to tensed propositions taken by Lucretian presentists, for whom tensed propositions are made true by tensed predicates of the *present* instant.

    Prior describes his own position thus:

    It is not quite right to say that the formalised languages of most current tense-logics have *no* present tense. The present is, on the contrary, the understood tense of any proposition that has no other specific tensing; and it is therefore the tense of the ‘atomic propositions’ or innermost kernels of all tensed constructions. There *has to be* such a tense if tense operators uniformly construct tensed propositions from tensed propositions; and moreover, this *has to be* a tense which every tensed proposition has even if it has no other (Prior (2003d), 173). [↑](#endnote-ref-22)
23. This point is made at greater length by Merricks (2007), 133-137; Sanson and Caplan (2010); and Baron (2013). [↑](#endnote-ref-23)
24. Cf. Baron (2015). [↑](#endnote-ref-24)
25. Cf. Aquinas, *DI* I. 5. 12. [↑](#endnote-ref-25)
26. The phrase comes from Contessa (2010). [↑](#endnote-ref-26)
27. The alternative formulation in terms of necessity states that whatever is necessary at an earlier time remains necessary at any time succeeding it; negatively, no necessity ever ceases to hold. [↑](#endnote-ref-27)
28. One could get around this by assuming that for any two times *t1* and *t2*, that if a power *P* is grounded in an entity *x* at *t*1, then there is an entity/entities, perhaps distinct from *x*, that grounds *P* at *t2* (for example, the elements out of which *x* might be composed). But this seems *ad hoc*. [↑](#endnote-ref-28)
29. Cf. *DI* I.14.8. [↑](#endnote-ref-29)
30. This assumption holds for infinite past time, as well as for circular time. [↑](#endnote-ref-30)
31. One may, of course, construct stronger modalities by defining the stronger modality in terms of the more primitive one, the truth-functional connectives, and tense operators, by restricting cases, etc. But one does not *begin* with these stronger modalities. [↑](#endnote-ref-31)
32. Cf. Malpass and Wawer (2012). [↑](#endnote-ref-32)
33. For further criticism of the role of the history parameter in temporal semantics, see Malpass and Wawer (2012). [↑](#endnote-ref-33)
34. For notational convenience, we leave out parentheses where this causes no confusion. [↑](#endnote-ref-34)
35. That is, names designate the same object *when* they designate. Rigid terms need not designate at all times. [↑](#endnote-ref-35)
36. For S0.5, see Priest (2008), ch. 4 & 18. For *L3* and Bochvar’s logic, see Malinowski (2001). [↑](#endnote-ref-36)
37. What does this restriction add? Presume it is not in place. Let @ = *t0*, *vt0*(*Pt*)=1, and presume there is a subset of all the times in *T* from *t0,* stretching back to *tk* the earliest world, such that *t0Lt0+1…Ltk-1Ltk.* Then since *t0Lt1, vt1*(♢*ϕ*)=1. For similar reasons, *vt2*(♢♢*ϕ*)=1. More generally for any two times *tn* and *tk* belonging to the history that has been realized up to the present, if *tnLtk*, *vtk*(♢*k-nϕ*)=1, where *k-n* is the number of iterations of ♢; but there would be occasions where *vtk*(♢*k – n + 1ϕ*) ≠ 1, thereby generating a sorites-type paradox for temporal modalities over times. Especially for times at a greater distance from each other, this seems excessively precise.

    The paradox also gives us reason, in the context of any more fine-grained account of future-oriented modals, to reject MacFarlane’s (2003) proposal that the truth value of propositions about the future at earlier times might have their truth values reassessed at later times. For if this were so, it would not be the time at which the future modal holds that would determine its truth-value, but its non-modal analogue holding at some later world; and this is exactly what generates the sorites outlined above. [↑](#endnote-ref-37)
38. Note that seriality must hold for enacted times if this definition is to work in the appropriate way. [↑](#endnote-ref-38)
39. And so the designation relation is informally interpreted as an instantiation relation. [↑](#endnote-ref-39)
40. Predicates in the other accidental categories would be more naturally regimented by polyadic predicates. See Aquinas, *In Metaph.* Bk. V, lec. 9 [↑](#endnote-ref-40)
41. As this sentence should make clear, we follow Prior’s (2003c) suggestion to identify times with the conjunction of propositions obtaining at the time. [↑](#endnote-ref-41)
42. Specifically, for times *t1*, *t2*, and *t3*, if *t2* is realizable by *t1*, and *t3* by *t2*, *t3* is unrealizable by *t1* for the simple reason that part of *t3*’s existence involves having the state of affairs *t2* as part of its past. So if we let [*t2*] stand for the conjunction of all formulae that hold at *t2*, *vt3*(𝒫[*t2*]) = 1, but for no world realizable by *t1* is this plausibly the case. [↑](#endnote-ref-42)
43. See Priest (1992). [↑](#endnote-ref-43)
44. Lewis (1973), 84. [↑](#endnote-ref-44)
45. Thus, Wyman’s distinction between the stronger ‘exists’ and the weaker ‘is’ is shown to have a perfectly acceptable interpretation. From the powers presentist identification of existence with actuality with being present, it follows that ‘being’ is said more fully of present beings than of non-present beings. This is represented in semantics by the adoption of actualist quantification, and the corresponding restriction of the predicate ‘exists’ to present beings. See Quine (1948), 23. [↑](#endnote-ref-45)
46. The condition should not, however, be taken as a sufficient one, since past worlds satisfy it as well. [↑](#endnote-ref-46)
47. For an illuminating discussion of the meaning of this Kantian phrase, see Heidegger (1961). [↑](#endnote-ref-47)
48. That this is so is suggested in the very fact that we use the same word, ‘will’, to express both futurity and the principle from which an action is elicited. The point is even more evident in the German use of *werden,* ‘to become’, to express the future tense. [↑](#endnote-ref-48)
49. See *De gen.* II. 11 [↑](#endnote-ref-49)
50. Pseudo Scotus (1968), 221. [↑](#endnote-ref-50)
51. Normore (1993), 85. [↑](#endnote-ref-51)