Powers presentism

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**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 radical overhaul of modal logic than even many 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; Future Contingents; Modality; Powers; many-valued logics; Tense logic; Substructural logics.

# 1 Introduction

This paper combines themes from dispositionalist accounts of modality and presentist philosophies of time into a unified account capable of solving the problems each faces on its own. Recent work on powers modality has begun to split into two camps: the one tending to focus on *synchronic* modality; the other, on *diachronic* modality. Adherents to the synchronic approach include Gabriele Contessa, David Yates, and others; while diachronic approaches seem to have first been advocated in recent times by E. J. Lowe, and have been defended at length by Barbara Vetter.[[1]](#footnote-1)

The default position of synchronic modalists[[2]](#footnote-2) is what I shall call *powers eternalism* – briefly, the thesis that i) modal truths are made true by the powers of actually existing things, and ii) that the scope of ‘actually existing’ here 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 what it is I take it an 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, then providing a semantics and philosophical interpretation of it.

# 2 The primary data of modality

In ordinary English, possibility is indicated in a variety of ways – by ‘could’ (“You could catch a cold in that weather”), ‘can’ (“Ralph can play the piano”), ‘might’ (“The cat might be the culprit”), ‘may’ (“Tamara may be late for the meeting”), and by suffixes such as –able (‘breakable’), -ible (‘irascible’), and –ile (‘agile’). The most common way to indicate possibility in ordinary English is by the auxiliary ‘can’.

Possibility covers a wide range of cases, not all of which are obviously of the same type. In the first of the above examples, the modal auxiliary indicates susceptibility; in the second, ability or skill; in the third, coherence with the known facts, etc.

Possibilities come in degrees: something is breakable if it can break; something is fragile if it can break *easily*.[[3]](#footnote-3) We may even use one and the same sentence (type) to express both that someone has a capacity and that they have that capacity to an eminent degree. “Forest can run!” has a different meaning ascribed to the disabled child than it does to the college football star.

Possibilities entail corresponding impossibilities: the irascible person can be easily provoked, and so cannot easily hold her temper; the temperate person can easily hold her temper, and so cannot be easily provoked.

Possibilities often come in pairs. It is senseless to call something ‘fragile’ if there are never any objects capable of remaining intact against the force that would break a fragile object.

Possibilities can come into being and cease to exist. I can speak French, but I wasn’t always able to do so.

Possibilities are goal-directed, or actuality-apt. To each possibility belongs its corresponding actualization, or manifestation. The capacity to ride a bike has, as its goal, the actual riding of bikes.[[4]](#footnote-4)

Most importantly, *possibilities are possibilities to be brought about*.[[5]](#footnote-5) They have their being as that which is available for enactment, and so, like necessity, share a relation to becoming. Making the point succinctly, we might say that *possibilia* are *generabilia*: possible states of affairs are states that can be brought into being; possible objects are objects that can be generated; possible properties are properties that can be gained, etc. Any philosophically grounded modal logic must, at minimum, be compatible with this point.

# 3 Powers eternalism

## 3.1 The place of powers theories in discussions of modality

Today, powers approaches to modality are among the most visible forms of actualism.[[6]](#footnote-6) 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.”[[7]](#footnote-7) 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)[[8]](#footnote-8)

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.[[9]](#footnote-9)

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. That they range over all present objects and properties
2. That they range over all past and present objects and properties
3. That they range over all past, present, and future objects and properties.

The first option seems to be presupposed in Vetter’s account of possibility;[[10]](#footnote-10) the second, by the accounts of Pruss[[11]](#footnote-11) and Simchen;[[12]](#footnote-12) the third, by those of Borghini and Williams,[[13]](#footnote-13) Jacobs,[[14]](#footnote-14) and Yates.[[15]](#footnote-15) Advocates of the first two options standardly approach modality diachronically; advocates of the third, synchronically.

## 3.2 The 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*>. Now, it is well-known that (tenselessly) actualist accounts validate the Barcan Formula: all the objects that ever exist are already in the domain of quantification; and so if ♢(∃*x*)Φ(*x*) holds, then it has to be the case that (∃*x*)♢Φ(*x*), i.e. some actually existing object must be a possible Φ-er. Similar reasoning suffices to show that these accounts validate the Converse Barcan as well.[[16]](#footnote-16)

What is new, however, is that powers themselves are given a quantificational structure. And so, for instance, the Barcan formula is analyzed as:

(PBF) (∃*y*)(∃Ψ)(Ψ(*y*) & ⟩[(∃*x*)Φ(*x*)](Ψ)) ⊃ (∃*x*)(∃*y*)(∃Ψ)(Ψ(*y*) & ⟩[Φ(*x*)](Ψ))

In philosophers’ English: if there is an object *y* with a power to bring it about that something is a Φ-er, then something can be made a Φ-er by *y*’s power. More plainly, generation of a new object with a given quality can always be traded in for accidental change in an existing object. The Converse Barcan, by contrast, states the opposite: that qualitative change can be traded in for the generation of a new object with the quality in question.

The problem, now, is that powers eternalism gives us all the objects there ever are, were, or will be; and so, the existence of an object that isn’t already within our domain is, strictly speaking, impossible.

To state the point more broadly. The primary data that a powers theory of modality is supposed to account for is the coming into being and the passing away of objects and their properties. 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; existence is necessary for things that exist, non-existence for things that don’t – 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,[[17]](#footnote-17) we can’t explain accidental generation or corruption, either. And so, given that powers are a kind of property, either a) there will be no powers to bring about powers, properties, objects, states of affairs, etc. that aren’t already there, i.e. something is only if it is necessary; or b) powers to bring about must be construed as something other than powers to bring into being. And so, either powers eternalism turns out to be useless as a theory of modality, or it turns out not to be a powers theory at all.[[18]](#footnote-18)

# 4 Semantics for powers presentism

## 4.1 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.[[19]](#footnote-19) 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,[[20]](#footnote-20) 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.[[21]](#footnote-21) 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 (iv), 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*}.[[22]](#footnote-22) 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.[[23]](#footnote-23)

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.

## 4.2 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*.[[24]](#footnote-24) 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*.[[25]](#footnote-25) 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 *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;[[26]](#footnote-26) 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.[[27]](#footnote-27) Within our semantics, future worlds are treated as *non-normal*. What should we make of this?

## 4.3 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.[[28]](#footnote-28) 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”[[29]](#footnote-29), 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.[[30]](#footnote-30)

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.[[31]](#footnote-31)

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.[[32]](#footnote-32)

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.[[33]](#footnote-33) This understanding of the future tense was already present in Aristotle;[[34]](#footnote-34) 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,[[35]](#footnote-35) 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.[[36]](#footnote-36)

In this way, the asymmetry between past and future is grounded in a deeper asymmetry between the manner in which 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.

# 5 Conclusion

The preceding has made the following points:

1. That dispositionalist accounts of modality have begun to split into two camps: those of powers eternalism, focusing on synchronic modality, and powers presentism, focusing on diachronic.
2. That synchronic modalists cannot give an account of the primary *analysandum* of natural modality – becoming.
3. That powers presentism, while providing a natural and intuitively satisfactory account of natural modality, requires a more radical, and weaker take on modal axioms than is normally taken.

The above does not solve the difficulties involved in this account. 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.

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

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1. See Bird (2007); Contessa (2013), (2015); Yates (forthcoming); 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. [↑](#footnote-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. [↑](#footnote-ref-2)
3. This point is made at length by Vetter (2014). [↑](#footnote-ref-3)
4. This is the reason why it is *prima facie* plausible to analyze certain statements about possibility, i.e. disposition ascriptions, in terms of stimulus: manifestation/cause: effect pairs. See Vetter (2014); cf. Lowe (2011), Nolan (2015). [↑](#footnote-ref-4)
5. Cf. Simchen (2006). [↑](#footnote-ref-5)
6. 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). [↑](#footnote-ref-6)
7. Vetter (2013), 1. [↑](#footnote-ref-7)
8. 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 (forthcoming). [↑](#footnote-ref-8)
9. 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. [↑](#footnote-ref-9)
10. “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)) [↑](#footnote-ref-10)
11. “[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)). [↑](#footnote-ref-11)
12. 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). [↑](#footnote-ref-12)
13. “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). [↑](#footnote-ref-13)
14. “[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. [↑](#footnote-ref-14)
15. “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 (forthcoming)). [↑](#footnote-ref-15)
16. The argument of this section is made at greater length in my ‘A note on dispositional modalities, constant domains, and the (4) axiom.’ [↑](#footnote-ref-16)
17. For reasons that we should, albeit in a different context, cf. Kripke (1972), 12. [↑](#footnote-ref-17)
18. I suspect that what is occurring is actually 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. [↑](#footnote-ref-18)
19. For notational convenience, we leave out parentheses where this causes no confusion. [↑](#footnote-ref-19)
20. That is, names designate the same object *when* they designate. Rigid terms need not designate at all times. [↑](#footnote-ref-20)
21. For S0.5, see Priest (2008), ch. 4 & 18. For *L3* and Bochvar’s logic, see Malinowski (2001). [↑](#footnote-ref-21)
22. 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. [↑](#footnote-ref-22)
23. Note that seriality must hold for enacted times if this definition is to work in the appropriate way. [↑](#footnote-ref-23)
24. And so the designation relation is informally interpreted as an instantiation relation. [↑](#footnote-ref-24)
25. Predicates in the other accidental categories would be more naturally regimented by polyadic predicates. See Aquinas, *In Metaph.* Bk. V, lec. 9 [↑](#footnote-ref-25)
26. As this sentence should make clear, we follow Prior’s (2003c) suggestion to identify times with the conjunction of propositions obtaining at the time. [↑](#footnote-ref-26)
27. 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. [↑](#footnote-ref-27)
28. See Priest (1992). [↑](#footnote-ref-28)
29. Lewis (1973), 84. [↑](#footnote-ref-29)
30. 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. [↑](#footnote-ref-30)
31. The condition should not, however, be taken as a sufficient one, since past worlds satisfy it as well. [↑](#footnote-ref-31)
32. For an illuminating discussion of the meaning of this Kantian phrase, see Heidegger (1961). [↑](#footnote-ref-32)
33. 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. [↑](#footnote-ref-33)
34. See *De gen.* II. 11 [↑](#footnote-ref-34)
35. Pseudo Scotus (1968), 221. [↑](#footnote-ref-35)
36. Normore (1993), 85. [↑](#footnote-ref-36)