# The Indeterminate Present

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**Abstract**

A non-solipsist form of presentness is usually thought to require the non-relative co-presentness of space-like separated events, where this requirement further implies the non-relative simultaneity of these events. Since special relativity is thought to rule out any global, non-relative simultaneity, typical non-solipsist forms of presentness are taken to be inconsistent with special relativity. To address this problem, we re-explain the relationship between the non-solipsism of presentness and co-presentness by appealing to metaphysical indeterminacy. We propose *presentness indeterminacy*, the thesis that where an event, *p*, is determinately present, any event in space-like relation to *p* lacks a determinate tense. We argue that for many theories of time, indeterminate co-presentness is all that the non-solipsism of presentness requires. Since there is no determinate co-presentness, the inconsistency between presentness and special relativity in these theories disappears.

**Keywords**

Presentness; A-theory; special relativity; indeterminacy; solipsism

# *Preliminaries*

The dynamic conception of time (or dynamic presentness for short) includes the following features: (1) thedynamicity of presentness—what is present keeps changing; and (2) thenon-solipsism of presentness—many different things can equally be present. In what follows “the present” or “presentness” is to be understood as having these features.

The first feature of dynamic presentness is satisfied by the *A-fact theory*: some states of affairs of the form [an event is present] obtain *simpliciter* and temporarily.[[1]](#footnote-1) (We shall use ‘[]’ to designate states of affairs.) That is, to say that an event is present is not to say that it occurs at a certain time, or that it is simultaneous with some other event, or with itself, since these relations do not change over time. Rather, the obtaining of certain states of affairs, such as [your reading this sentence is present], does not last forever, hence satisfying (1). Call states of affairs with this feature “A-facts*”*, and call the property of being present an “A-property”. A-properties include presentness, pastness, and futurity (and maybe some other properties derived from or underlying these three properties). The A-fact theory is a kind of realism about tensed facts in Fine’s (2005) sense.[[2]](#footnote-2) The A-fact theory is arguably compatible with both presentism, the thesis that only present things exist, and eternalism, the thesis that past, present, and future things equally exist. For the purposes of this paper we assume eternalism, and we make no claim that our account can underwrite (standard) presentism.[[3]](#footnote-3)

It is usually accepted that if there are A-facts at all, then the most certain instances concern events that are happening to *oneself*. In fact, A-theorists usually take the knowledge of events presently happening to oneself as the ground for constructing such a theory. For example, Zimmerman (2011, 190) argues for the existence of the present hyperplane in Minkowski space-time, and the first premise of his argument is that “there is an objective, important difference between events that are really happening to me, and ones that merely did or will happen to me.” However, any view that accepts both eternalism and A-facts courts a potential epistemic problem. For example, Braddon-Mitchell (2004, 202-203) contends that “the existence of past agents undermines any reason those who are present might have for believing they are present.” This paper does not aim to address this epistemic problem, but instead concerns a serious *metaphysical* problem (to be explained shortly). Hence we shall simply assume, with Zimmerman (2011), that one can know which event along one’s world-line is present.

Dynamic presentness—the A-fact theory together with the non-solipsism of presentness—is challenged by its apparent inconsistency with the Einstein-Minkowski interpretation of special relativity. On Jhou’s (2017) analysis, the problem can be formulated as the inconsistency of the following four widely accepted theses:

(Realism) A dynamic, non-solipsist form of presentness exists.

(Co-Presentness) A dynamic, non-solipsist form of presentness requires some space-like separated events to be present simpliciter together.

(Link) The dynamic co-presentness of two space-like separated events implies their distant, non-relative simultaneity.

(Lack) There is no distant, non-relative simultaneity in Minkowski space-time.

From (Realism) and (Co-Presentness), there must be at least two distinct obtaining A-facts such as [*p1* is present] and [*p2* is present], where *p1* and *p2* are space-like separated events. According to (Link), if *p1* is present and *p2* is present, then *p1* and *p2* are non-relatively simultaneous. This is clearly contrary to (Lack). Since (Lack) is embraced by most philosophers as well as physicists, and since (Link) and (Co-Presentness) are deemed uncontroversial, many think the inconsistency problem indicates that (Realism) is faulty. That is, there is no dynamic presentness.

Jhou (2017) points out that while there have been attempts to recover dynamic presentness in modern physics by rejecting (Realism) or (Lack), there hasn’t been one that challenges (Co-Presentness). In response, Jhou (2017) proposes *exclusive disjunctivism*, the thesis that many mutually space-like separated things are present *simpliciter exclusively disjunctively*, and argues that such presentness is non-solipsist.

Although we follow Jhou (2017) in focusing on (Co-Presentness), our approach here is to weaken or reinterpret (Co-Presentness) rather than to reject it. That is, our approach preserves a form of co-presentness that to some extent accords with our pre-theoretical notion of dynamic presentness. Our approach is *minimalist* in that it employs only a notion of indeterminacy (similar to quantum indeterminacy) to weaken co-presentness. Our thesis, which we call “presentness indeterminacy,” is that there is only indeterminate co-presentness of mutually space-like separated events, in the sense that where an event, *p*, is *determinately* present, any event in space-like relation to *p* lacks a determinate tense—i.e., such an event has only *indeterminate presentness*. If indeterminacy succeeds, then (Link) and (Lack) are no longer inconsistent with (Realism), because there is no determinate co-presentness associated with non-solipsist dynamic presentness. Moreover, since indeterminacy preserves a form of co-presentness, it improves on Jhou’s exclusive disjunctivism, according to which there is no co-presentness of any kind.

It is worth comparing our approach to the typical use of indeterminacy in the philosophy of time. It is not rare in the literature to employ a notion of indeterminacy or indefiniteness to characterize what is *merely possible* as opposed to what *has become* as of a space-time point in Minkowski space-time. For example, Stein (1991, 148) takes it to be uncontroversial that “[t]he state at any point *a* is already definite as of *a* itself [and] [f]or any point *a*, there are points whose state is still [indefinite] as of *a*.” For another example, Pooley (2013, 348) thinks there is a pattern of “relational indeterminacy” as follows:

“to say that all and only events in the past lightcone have become, as of some spacetime point *p*, is to say that, while there is a unique matter of fact concerning what has occurred in all regions to the past of *p*, there are (as of *p*) a plurality of possibilities open for regions of spacetime to the absolute future of *p and in its elsewhere*.”

This Steinian approach is not without potential problems (e.g., Dorato 1996).

However, problems aside, the Steinian project is distinct in two important ways from ours. First, the Steinian notion of *having-become* is non-dynamic, in the sense that *every* event in space-time has become *as of itself*. By contrast, on our view, presentness is *dynamic*: although every event on my world line satisfies a same-time relation with itself, only one event on my world-line is *present*, and *which* event is present is constantly changing. Secondly, on Steinian views, there is no distinction between the absolute future and the elsewhere of *p*, since these are all mere possibilities as of *p*. By contrast, our notion of indeterminacy concerns *only what is present* without any commitment to the open future. That is, what is at issue is just the *elsewhere* of *p*, and even there, only the indeterminacy of *presentness*. Steinian views assume an indeterminacy about the *contents* of space-time. By contrast, our view assumes eternalism: the contents of every spatiotemporal location are fully determinate. On our view, all that is indeterminate is presentness. We are not attempting to account for any putative indeterminacy in future events (and certainly not addressing quantum non-locality).

Finally, we do not have to address worries about vague *identity* (Evans 1978). We assume that identity conditions for spatiotemporal events can be specified, and that the identity or otherwise of two events is always determinate. The indeterminacy we consider concerns only the tense properties of events: where *p* is present, it can be indeterminate whether a distinct event *q* is present. But we assume that *p* and *q* always have *other* properties that determinately distinguish them.

In order to explain our position concerning the present, we need to say what is it for presentness to be indeterminate. We mean that it is indeterminate in the same sense in which the quantum world is often said to be indeterminate—that is, *metaphysically* rather than epistemically or semantically. But that requires some spelling out.

# *Metaphysical Indeterminacy*

Consider a particle whose quantum state (wave function) is spread over some spatial region *R*—that is, the state has zero amplitude everywhere outside *R*, and non-zero amplitude everywhere inside *R*. According to one way of understanding this state, the particle is in region *R*, but it cannot be ascribed a more precise location within *R*. This view can be spelled out by appeal to the *eigenstate-eigenvalue link*, according to which a system has a determinate value for a given property if and only if its state is an eigenstate of the operator corresponding to the property (Lewis 2016, 76). The state just described is an eigenstate of a binary inside-*R*/outside-*R* operator, but it is not an eigenstate of any finer-grained location operator.[[4]](#footnote-4) That is, the particle is determinately in region *R*, but it has no more precise determinate location within *R*. We can call this *quantum indeterminacy*.

Where quantum indeterminacy is recognized, it is typically taken to be genuine indeterminacy *in the world*: it is not that we simply *don’t know* the location of the particle, or that the *meanings* of the central terms in our claims are somehow vague. Indeed, defenders of metaphysical indeterminacy tend to take quantum indeterminacy as a paradigm example (Calosi and Wilson 2019). But of course, any claim about the world according to quantum mechanics is liable to be controversial, and this certainly applies to claims about indeterminacy: while Lewis (2016) argues that all the major interpretations of quantum mechanics incorporate indeterminacy, Glick (2017) argues that none of them do. Nevertheless, our proposal does not depend on whether quantum mechanics really requires indeterminacy, or whether quantum indeterminacy is genuinely metaphysical: we simply take quantum indeterminacy as an example to illustrate what we have in mind by metaphysical indeterminacy.

But what exactly is metaphysical indeterminacy? There are two central accounts in the contemporary literature, Barnes’ (2010) modal precisificationist account and Wilson’s (2013) determinable-based account. According to Barnes’ account, every state of affairs is fully determinate, but it is indeterminate which state of affairs obtains. So in the quantum particle case, there is a continuum of states of affairs, in each of which the particle has some precise, determinate position within *R*, but it is indeterminate which of these states of affairs obtains. Nevertheless, for each of these states of affairs, the particle is determinately in *R*, and so on a supervaluationist semantics, it is determinate that the particle is in *R*.

According to Wilson’s determinable-based account, on the other hand, it is determinate which state of affairs obtains, but that state of affair may itself be indeterminate. This indeterminacy at the level of the state of affairs is analyzed in terms of determinables and determinates: the system concerned has a determinable property, but no unique determinate value for that determinable. The lack of a unique determinate value could be *glutty*—there are too many candidate determinates—or *gappy*—there are no determinates at all. In the quantum particle case, the particle has the position determinable, but no unique determinate value of position, either because there are too many candidate positions, or none at all. Nevertheless, the particle is determinately in region *R*—in this case, not because of a supervaluationist analysis, but simply because the particle *does* have a determinate value for the coarse-grained inside-*R*/outside-*R* determinable.

We do not take a position here on *how* metaphysical indeterminacy should be analyzed; we simply note that at least two candidate analyses are available. Our interest lies in seeing how an appeal to metaphysical indeterminacy can help defend presentness in the context of special relativity.

# *Metaphysical Presentness Indeterminacy*

Why, and in what way, is there a kind of genuine, metaphysical indeterminacy about presentness? Let’s start with the case where presentness is determinate. Some event on your world-line *A* is present, e.g. *p*, the event of your reading this sentence. That event has determinate presentness. (As explained in section 1, we assume that you can know which event along your world-line is present.)

[FIGURE 1].

But now consider a distinct world-line *B*, and suppose that *q* is an event on *B* that lies within the elsewhere of your present event *p*, i.e. it lies outside *p*’s past and future light cones (figure 1). Is *q* present? According to special relativity, there is a continuum of references frames we can construct, and each of these reference frames designates some point on *B* as simultaneous with *p*. Event *q* is simultaneous with *p* in exactly one of these frames; in the remaining frames, *q* is earlier than *p* by various amounts, or later than *p* by various amounts. All these frames are equally good, since, according to (Lack), there is no distant, non-relative, non-conventional simultaneity in Minkowski space-time. Appealing to (Link), which links co-presentness to distant simultaneity, it follows that pastness, presentness, and futurity are equally good candidates for the tense of *q*. And this is where we can appeal to metaphysical indeterminacy.

Applying Barnes’ (2010) modal precisificationist account, we can distinguish three determinate states of affairs: [*q* is past], [*q* is present], [*q* is future]. But there is nothing in the world that makes it the case that one rather than another of these states of affairs obtains: it is indeterminate which of them obtains. In fact, we can divide things up more finely if we like, making the case more analogous to that of the quantum particle. That is, we can distinguish a continuum of determinate states of affairs, in each of which *q* is some precise amount of time earlier or later than *p*, including one in which *p* and *q* are simultaneous. Again, it is indeterminate which of these states of affairs obtains. But in each of these states of affairs, *some* event within the elsewhere of *p* is present. So applying supervaluationism, we can say that it is determinate that some event in the elsewhere of *p* is present.

Alternatively, if we apply Wilson’s (2013) determinable-based account of metaphysical indeterminacy, then it is determinate which state of affairs obtains, but that state of affairs is itself indeterminate. The state of affairs that obtains is such that the determinable “tense” applies to *q*, but *q* lacks a determinate tense. That is, *q* is not determinately present, or determinately past, or determinately future; nor is *q* determinately some precise amount of time earlier or later than *p*. The lack of a determinate tense for *q* could be given a glutty or a gappy explanation: it could be that there are too many candidates for the tense of *q*, or it could be that there are no candidates at all (although in this case, the glutty option strikes us as more appropriate). In any case, it is determinate that the present event on world-line *B* lies within the elsewhere of *p* rather than in the past or future light cone of *p*. That is, a coarse-grained binary determinable, corresponding to whether or not the present on *B* lies inside or outside the elsewhere of *p,* has a determinate value, namely *inside*. But this is an irreducible determinate property; it is not the product of some supervaluationist analysis.

On either of these analyses, the tense of *q* is indeterminate. Hence, just as the eigenstate-eigenvalue link (arguably) specifies quantum indeterminacy, we propose the following view, which we call *presentness indeterminacy*:

Where an event, *p*, is determinately present, any event in space-like relation to *p* lacks a unique determinate tense, in which case, such event can be said to have only *indeterminate* presentness.

A couple of features of this view are worth pointing out. First, it is only the events space-like separated from *p* that have no determinate tense. Events in the past light cone of *p* are determinately past, and events in the future light cone of *p* are determinately future. So the temporal extent of presentness indeterminacy varies with distance from *p*. If I am in Boston and my friend is in Taipei, then my friend’s present is strictly indeterminate, but nevertheless it is determinate that it lies on the segment of their world-line between my past and future light cones—i.e. an interval of around a tenth of a second.[[5]](#footnote-5) If I am wondering what my friend in Taipei is doing right now, this indeterminacy makes no practical difference. Only in science fiction cases might presentness indeterminacy make a difference: if my friend is orbiting Alpha Centauri, then their present is only determinately within an 8-year interval, so it really doesn’t make much sense to wonder what they are doing right now.

Second, the word “where” in the definition of presentness indeterminacy is to be taken literally: determinate presentness is defined only relative to the specification of a world-line. Points on two distinct world-lines are never both determinately present, except where those world-lines intersect. But then how does presentness indeterminacy preserve the non-solipsism of presentness, in the sense that many different things can *equally* be present? First, to say that *determinate* presentness is relative to a world-line is not to say that *all* presentness is so restricted. If I were on a different world line, then a different spatiotemporal location would be determinately present. Even from my perspective, it is not that there are *no* determinate facts about distant presentness: recall that from my perspective in Boston, I can pinpoint which time is present for my friend in Taipei to within a tenth of a second. It is determinate that my friend’s present lies within this interval, so there are determinate facts about distant presentness. This idea is further elaborated in the next section.

# *Addressing the Inconsistency Problem*

How can presentness indeterminacy help resolve the inconsistency problem? The idea is that metaphysical indeterminacy concerning which events are present prevents the co-presentness of mutually space-like separated events from conflicting with special relativity.

Given (Lack) and (Link), there is no dynamic co-presentness of two space-like separated events—that is, there cannot be two or more space-like separated events which are determinately present together. Since our goal is to make room for the non-solipsism of presentness, which is required by (Realism), we need to identify a sense in which many different things can equally be present. And the logical space for such position is open if we weaken (Co-Presentness) as suggested by indeterminacy:

(Weakened Co-Presentness): Non-solipsist dynamic presentness requires some space-like separated events to be *indeterminately co-present*.

To say that two events are *indeterminately co-present* means that where one is present, the other has no unique determinate tense. (Weakened Co-Presentness), (Lack) and (Link) are consistent with (Realism), since there is no requirement of determinate co-presentness.

Alternatively, instead of weakening (Co-Presentness), we can rewrite it is as follows:

(General Co-Presentness): Non-solipsist dynamic presentness requires that for every present event, *some* space-like separated event isco-present.

This definition is *general* in that it applies in both the classical (neo-Newtonian) and special relativistic case. In the classical case, it applies straightforwardly: for every present event, there are specifiable events that are co-present with it. But it also applies in the special relativistic case, given presentness indeterminacy and an appropriate understanding of existential quantification. That is, on either approach to metaphysical indeterminacy, it is determinately the case that *some* space-like separated events are co-present with my present. That is, for any world-line distinct from my own, it is determinately the case that *some* event on the segment of the world-line within my elsewhere is present. On the modal precificationist account, this follows from a supervaluationist analysis: the existentially quantified claim is true in each of the precise states of affairs between which the world is undecided. On the determinable-based account, it follows because a coarse-grained determinable concerning the location of presentness on the distant world-line has a determinate value: it is determinately *inside* rather than *outside* my elsewhere. In either case, some space-like separated events are co-present with my present, and hence there is no threat of solipsism.

Now we can see a clear distinction between Jhou’s (2017) exclusive disjunctivism and presentness indeterminacy. Where an event, *p*, is present, exclusive disjunctivism maintains that all distant events are not present. Presentness indeterminacy, on the other hand, maintains that all distant events are *indeterminately* present—that is, that while it is determinately the case that *some* distant events are present, it is not determinately the case of any particular distant event that it is present.

# *Some Objections*

To close, let’s consider some potential objections to presentness indeterminacy. First, one might suspect that the advertised consistency of (Realism), (Lack) and (Link) with (Weakened Co-Presentness) or (General Co-Presentness) is illusory. Since, from the perspective of each world-line, some event is present, one might think that we can simply string all these present events together into a preferred hyperplane of simultaneity, in violation of (Lack). But in fact, because of the world-line relative nature of determinate presentness facts, no such construction is possible. Consider world-lines A and B, and suppose that, from the perspective of world-line A, event *p* is present, and from the perspective of world-line B, event *q* is present. Present events on each world-line are *temporary*: they are not *always* present. So to ascertain whether the two events are *co*-present, we have to be sure that they are present *at the same time*. But it is precisely this comparison between the events that is unavailable due to (Lack). Put another way, since the presentness of any event is restricted to a world-line, no determinate *co*-presentness of space-like separated events is available, and so no preferred hyperplane can be constructed out of co-present events.

In order to better visualize this point, consider the moving spotlight metaphor. In a classical (neo-Newtonian) space-time, what is lit up by the spotlight is an entire hyperplane of simultaneity; hyperplanes of simultaneity are illuminated successively (Savitt 2006, 123). In Minkowski space-time, what is lit up by the spotlight is a point on a world-line; for any world-line, the points are illuminated successively. But except where two world-lines intersect, no temporal comparison of illumination *between* world-lines is possible. If, from the perspective of world-line A, event *p* on world-line A is illuminated, there is no fact of the matter about whether event *q* on world-line B is illuminated—or whether, instead, it *was* illuminated or *will be* illuminated. Much as we might like one, no *global* perspective on illumination order is available. But this lack of a global perspective does nothing to undermine the correctness of the claim that points on a world-line are illuminated *successively* (dynamicity), or the claim that *exactly one* point on each world-line is illuminated (non-solipsism).

Second, one might object that, rather than being *indeterminate*, the presentness of a distant event is simply *frame-relative*. After all, it is common in discussions of special relativity to see space-like separated events described as being *simultaneous in an observer’s rest frame*. Hence, one might think, the tense of an event that is space-like separated from me is fully determinate, once one relativizes the tense to my rest frame. But it is important to note that frames of reference are entirely conventional: they are *choices* of coordinates. The choice of coordinates in which I am at rest is often particularly convenient for me to use, but it has no special ontological significance: it is not an objective fact that I am at rest. Rather, my state of motion or rest and the tense of events in my elsewhere are equally indeterminate: a choice of frame fixes them both. So although it is technically correct to say that the tense of distant events is determinate relative to a choice of frame, this does not make the tense of distant events determinate, since there is no *correct* choice of frame*.* Choosing a frame is a way of picking from among the states of affairs between which the world is undecided (using Barnes’ terminology), or a way of specifying a determinate state of affairs that is distinct from the actual, indeterminate one (using Wilson’s).

Furthermore, describing presentness as frame-relative strikes us as potentially misleading. In Barnes’ terminology, to say that presentness is frame-relative is to say that the states of affair between which the world is undecided are complete hyperplanes of simultaneity through my present event *p*—that all the present events lie on one such hyperplane, but it is indeterminate which one. But this seems insufficiently general: since there is no determinate distant co-presentness, *any* way of assigning presentness to events such that *p* is present and co-present events are space-like separated constitutes a possibility, whether or not such events lie on a hyperplane. It is better, we think, to say that determinate presentness is relative to a *world-line*.

Finally, given this world-line relativity, one might worry about the coordination of present events on different world-lines. To make this concrete, consider the standard “twin paradox” scenario: the twins start off at the same location, one of them takes a fast space flight, and then they meet again at the same location. According to special relativity, the traveling twin ages less than the non-traveling twin. But if she ages less, won’t that make her present lag behind that of the non-traveling twin when they get back together? Fortunately, the light-cone restrictions on indeterminacy prevent this kind of mismatch. Before the trip, the twins are in essentially the same location, so their presents essentially coincide. As they move apart, the temporal extent of the indeterminacy in the present of one from the perspective of the other increases, and then it decreases as they move back together, ending in a situation in which their presents essentially coincide again. During the voyage, more time has elapsed for the non-traveling twin, but this doesn’t result any mismatch in their presents when they get back together. One might think that this means that the present for the non-traveling twin must “move faster” than the present for the traveling twin, but given the indeterminacy in the location of one twin’s present from the perspective of the other, we doubt that any determinate sense can be made of such an assertion.

1. *Conclusion*

Presentness indeterminacy maintains that there is only indeterminate co-presentness in Minkowski space-time, because where an event, *p*, is present, any event in space-like relation to *p* lacks a determinate tense. Since there is no determinate co-presentness, (Lack) and (Link) are consistent with (Realism) and the inconsistency problem is thereby resolved. Moreover, given that indeterminacy preserves a form of co-presentness, it supplements and is therefore better than Jhou’s exclusive disjunctivism, according to which there is no co-presentness of any kind. Because of the minimalist nature of presentness indeterminacy, it on the one hand leaves intact the central doctrines of relativistic physics (including the Einstein-Minkowski interpretation of special relativity, the objectivity of standard simultaneity, and the strong conventionality of simultaneity), and on the other preserves the virtues of dynamic presentness – dynamicity and non-solipsism.

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1. This characterization of A-theories in terms of obtainment *simpliciter* is the counterpart of Zimmerman’s (2005, 433) and Skow’s (2012, 223) in terms of truth *simpliciter*. According to Zimmerman (2005, 433), no matter what ontology of propositions one adopts, an A-theorist may insist (and no self-respecting B-theorist should accept) that “some of these things are true, *simpliciter*, and that this class includes ones that will become or once were false.” This kind of truth, which is not relative to anything, is to be distinguished from various kinds of relative truth, such as true-at-a-time or true-simultaneously-with-such-and-such-event, etc. [↑](#footnote-ref-1)
2. Tensed facts for Fine (2005) include facts like [Fine is sitting] or [Fine is standing]. The A-facts in this paper have the form [an event is present], which should be distinguished from tensed facts like [Fine is sitting]. Fine’s two tensed facts are incompatible because one cannot be both sitting and standing, whereas A-facts like [my eating breakfast is present] and [my eating lunch is present] are incompatible because two non-simultaneous events cannot both be present. A-facts of this latter kind can be regarded as a special kind of tensed fact in Fine’s (2005) terms. The A-fact theory accepts *realism* about tensed facts and *absolutism* about how tensed facts constitute reality, but it is silent about *neutrality*, according to which reality is not inclined to one particular time, and *coherence*, according to which reality is constituted by compatible facts. [↑](#footnote-ref-2)
3. If presentism is formulated in such a way that it is compatible with eternalism (e.g. Savitt 2006), then we see no reason why our account should not underwrite presentism. Furthermore, by restricting our account to eternalist theories of time, we hope to avoid the worry that presentness amounts to *existence*, and hence is not a property (Craig 1997). [↑](#footnote-ref-3)
4. By a *location operator* we mean an operator that has eigenstates in which the state is non-zero only within some finite spatial region. We do not mean the *position* operator, since perfectly precise position eigenstates are not well-defined physical states. [↑](#footnote-ref-4)
5. We assume that presentness is strictly point-like, at least as an idealization. [↑](#footnote-ref-5)