Numerical Quantification and Temporal Intervals:
A Span-er in the Works for Presentism?

Abstract:

Arthur Prior states that 'It will be/was/is that *p*' is true iff '*p*' will be/was/is true, and that is all that needs to be said about the matter. This appears to avoid any need to invoke the existence of non-present entities and accounts for tensed truths with very little ontological cost. However, as David Lewis notes, this version of presentism gives the wrong results when applied to numerically quantified tensed propositions. I show how presentism can accommodate numerical quantification by introducing a more appropriate tense operator. Further, I argue that it is implausible to think that we can have a primitive understanding of it; the correct semantics involves quantification over past and future times. I go on to show what kind of ontology can complement this semantic story, whilst remaining presentist in nature.

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In *Time and Modality*, Prior states that the truth-conditions for both modal and tensed statements have the following form (F):

(F)   'It will be/was/could be that *p*' is true iff '*p*' will be/was/could be true.[1]

For example, the past-tensed statement 'There was some toe-sucking afoot' is true iff the present-tensed statement 'There is some toe-sucking afoot' was true. We can notate tensed statements using the tense operators **P**, **N** and **F** (read 'It was the case that', 'It is (now) the case that', and 'It will be the case that', respectively) operating on present-tensed propositions, and can notate modal statements using the modal operator ◊ (read 'It could be the case that') operating on indicative propositions, and write the truth-conditions thus:

(1)   '**P***p*' is true iff '*p*' was true.
(2)   '**N***p*' is true iff '*p*' is true
(3)   '**F***p*' is true iff '*p*' will be true
(4)   '◊*p*' is true iff '*p*' could be true

Complex tenses can be notated by iterating these basic tenses, and it is easy to see how they fit into the above scheme. For instance, '**FP***p*' is true iff '**P***p*' will be true, where '"**P***p*" will be true' is true iff '"*p*" was true' will be true. We can also establish more precisely when '*p*' is true by introducing metric tense operators which indicate not just that something was the case, as **P** does, but *when* it was the case.[2] For example, if the basic unit of time is an hour, 'There was some toe-sucking three hours ago' can be written '$\mathbf{P}^3 p$'. Prior comments on (1)-(4) that 'semantic rules of this sort were stated by the schoolmen, and they are after all very simple and obvious'.[3] But it is one thing giving such obvious semantic rules, and quite another giving an account of what appears on the RHS of such biconditionals. Everyone can agree on some given truth-conditions, yet still disagree over what, if anything, is needed to *make* such statements true.

An elegant, transparent, and hence popular account of (1)-(3) is to hold that past-tensed statements are now true in virtue of certain concrete facts located earlier than now; present-tensed statements are now true in virtue of certain concrete facts located simultaneously with now, and future-tensed statements are now true in virtue of certain concrete facts located later than now. According to this view, Edgar the Peaceable (c.942-975CE) and Edgar the Atheling (c.1051-c.1126CE) are as real, as much flesh and blood monarchs of England, as the current one is; it is just that they are located at times earlier than the times at which Queen Elizabeth II is located. It is, then, the flesh and blood Edgar the Atheling and his attributes that serve to make statements about him true.[4]

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[1] See Prior (1957: 9)

[2] Prior (1957: 11-13)

[3] Prior (1957: 9)

[4] For early versions of this view, see, for instance, Russell (1915), Broad (1921), Goodman (1951), Williams (1951), Quine (1960), Smart (1963), Grünbaum (1967). For later, improved, versions, see, for instance, Smart (1980), Mellor (1981) and (1998), Oaklander (1984) and Le Poidevin (1991). McCall (1994) and Tooley (1997) also hold this view about the past and present, but Tooley differs in thinking that there are no concrete times later than the present, and McCall differs in thinking that, although only one concrete future will be actualised, there is more than one concrete future as of the present time (see my (2006) for criticisms of Tooley and McCall).

An equally elegant and transparent – but not so popular! – account of (4) is to hold that modal statements are true in virtue of certain concrete features of other worlds. Statements concerning what I could have done are true in virtue of what I (or rather my equally real, flesh and blood counterpart located in another world) does do.[5]

Prior rejects any need for either of these accounts. He sees no need to go beyond a minimal reading of (F), and thus sees no need to invoke the existence of non-present or non-actual beings. This makes Prior a presentist. But it makes him a presentist of a particular sort. The obvious feature of this account is that, since 'will be/was/could be' appear on both sides of the biconditional in (F), it does not give us an analysis of the relevant terms. Yet one good thing that analyses give us is a clearer idea of what would make such statements true, as we get with the accounts mentioned above that explicitly quantify over non-present and non-actual concrete times and worlds. On Prior's account, however, although we may well know how the present has to be in order for 'There is a king of England named Edgar' to be true – we know what the constituents of the fact would be, and how it is composed –, we are in left in the dark about what must be the case in order for 'There was a king of England named Edgar' to be true. For 'There was a king of England named Edgar' is a present truth; but what now can make it true, if the past object Edgar no longer exists? Just leaving it as a brute (present) fact that something was the case leaves us with too many unanswered questions.[6] But, of course, this variety of presentist won't feel the need to answer such questions; so it would be a better strategy for an opponent to find some other charge to bring against such a position.[7]

One such charge surrounds problems with numerical quantification. Take a modal case, such as:

(5)   There are several ways in which Deep Blue could win this chess game

This is easily dealt with by a defender of the view that there are non-actual *possibilia*: each of the ways in which Deep Blue could have won is a way that some concrete counterpart of it does win; so if there are such ways, then (5) is true. Prior's truth-conditions, however, go awry. Fitting (5) into the form (F) gives:

(5a)   'There are several ways in which Deep Blue could win this chess game' is true iff 'There are several ways in which Deep Blue wins this chess game' could be true

But since the sentence on the RHS of the biconditional in (5a) could not be true, something is amiss with this way of taking the modal operator as primitive. A similar problem with numerical quantification occurs for tenses, as Lewis (2004) points out. Consider:

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[5] See, for instance, Lewis (1986), who calls his view 'genuine modal realism'.

[6] Various options for finding truthmakers in the present for past-tensed statements are discussed and rejected in my (2006).

[7] One charge that I bring against this version of presentism (in my (2006)) is that it fails to guarantee the truth-value links between various times, such as that $p \supset \mathbf{FP}p$. This is a fatal flaw in any theory of time, but it is one I shall ignore for our present purposes. What is interesting to note, however, is that the failure to guarantee the truth-value links is a consequence of the fact that the primitive facts that presently exist concerning what happened and will happen *change* over time, and because times are distinct entities, it is hard to see what guarantees that when the next time comes into existence, its primitive facts will link up with what the facts were when the previous time existed. But since modal facts holding at the actual world do not change in this way, primitivism about modality avoids this particular objection, and is in a much stronger position than primitivism about tense.

(6)　　　There were (exactly) two kings of England named Edgar

and its respective truth-condition according to the form (F):

(6a)　　　'There were two kings of England named Edgar' is true iff 'There are two kings of England named Edgar' was true

i.e., where 'K' means *is a king of England named Edgar*, iff

(6b)　　　$\mathbf{P}\exists x\exists y(((Kx \ \& \ Ky) \ \& \ x{\neq}y) \ \& \ \forall z(Kz \supset (z{=}x \lor z{=}y)))$

The problem with translating (6) as (6b) is that (6) could be true without it ever being that

(6c)　　　$\exists x\exists y(((Kx \ \& \ Ky) \ \& \ x{\neq}y) \ \& \ \forall z(Kz \supset (z{=}x \lor z{=}y)))$

was true at any particular time; indeed, as we have seen, they did not rule at the same time. This renders (6) true and (6b) false.

　　　Lewis considers various strategies for translating (6) using Prior's operators, but dismisses them all. We need not go through his arguments here, since, on reflection, this should come as no big surprise: Prior's tense operators were made only for dealing with statements that are true at a particular time, whereas the examples demand an operator capable of spanning various times. If presentism is to survive, then, we need to add such an operator to the Priorian tense logic.

　　　Let us introduce such an operator. To make it explicit that it is a past-tense span operator, let us notate it as 's**P**an'. We can then specify the times that it spans in a similar way to the ordinary metric tense operators above, as follows:

's**P**an$^{>0}$' is read 'It was the case during all of the past that'
's**P**an$^{<0}$' is read 'It will be the case during all of the future that'[8]
's**P**an$^{\geq 0}$' is read 'It was the case during all of the past, and is the case in the present, that'
's**P**an$^{\leq 0}$' is read 'It will be the case during all of the future, and is the case in the present, that'

We can indicate even more specific intervals by notating the superscript as follows:

Open intervals:	$]a, b[$	$a < n$ units ago $< b$
Closed intervals:	$[a, b]$	$a \leq n$ units ago $\leq b$
Half-open (or half-closed) intervals:	$[a, b[$	$a \leq n$ units ago $< b$
	$]a, b]$	$a < n$ units ago $\leq b$

For example, if we are dealing with units of one year, 's**P**an$^{[2000, 3000[}$' is read 'It was the case during the interval of precisely 2000 years ago up until but not including 3000 years ago that'.

　　　With this understanding, presentists can then notate the problematic numerically quantified statement (6) as:

(7)　　　s**P**an$^{>0}$(There are two kings of England named Edgar)

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[8] We could, of course, introduce a separate operator for the future, but this shows that there is no need for it, and, for obvious reasons, the 's**P**an' notation is much lovelier than 's**F**an'.

i.e.,

(7a) $s\mathbf{P}an^{>0}(\exists x \exists y(((Kx \ \& \ Ky) \ \& \ x{\neq}y) \ \& \ \forall z(Kz \supset (z{=}x \lor z{=}y))))$

This no more commits presentism to the existence of the two Edgars than the truth of the more standard

(8) $\mathbf{P}$(There is a king of England named Ethelweard)

commits us to the existence of Ethelweard. It looks like presentism can survive, then, if it introduces the span operator.

Lewis's objections to taking span operators as primitive, however, are that 'they create ambiguities even when prefixed to a sentence that is not itself ambiguous' (Lewis (2004: 12)), such as when prefixed to 'It is moist and it is turgid', which could mean that it is both moist and turgid at some time during that interval, or could mean that, during the interval, it is moist during one subinterval and turgid during another. A special case of this is where 's$\mathbf{P}$an' prefixes to contradictory sentences, such as 'It is turgid and it is flaccid', to make a truth. In light of these features of the operator, Lewis claims that it is so unmanageable that we cannot claim to have a primitive understanding of it.

It is not clear, however, that it is all that unmanageable. To disambiguate such sentences, some presentists may claim that all that has to be said is:

(9) $s\mathbf{P}an^{>0}$(It is moist & it is turgid) & $\sim\!\mathbf{P}$(It is moist & it is turgid)

If they are right, the upshot is that there is no argument from lack of expressive power against a presentist who takes tense operators to be primitive, so long as they include spanners in their toolkit. It looks more like, insofar as this issue goes, we have arrived at a stalemate.[9]

Nevertheless, many of us think that our understanding of a claim like (9) does not bottom-out with this bare statement. What grounds our understanding of such operators, not to mention our understanding of '&' within this context? I feel moved to say that our grasp of (9) is based in our taking 's$\mathbf{P}$an$^{\tau}$' to mean that *there is an interval of time τ during which* and '$\mathbf{P}$' to mean that *there is a past time at which*. But since this alternative to taking the operators as primitive quantifies over non-present times and intervals, the moral that many will draw is that we must either adopt presentism with its primitive operators, or give an account of the operators that quantifies over non-present objects and abandon presentism. But drawing that conclusion would be hasty: there is middle ground between these two options, since it is possible to be a presentist without having to take the operators as primitive.

The position that I have in mind is analogous to the so-called 'ersatz modal realism', which I take to hold the middle ground between Lewis's genuine modal realism and Prior's modal primitivism.[10] For although such positions give an account (albeit non-reductive) of the modal operators in terms of possible worlds, they fall short of committing themselves to non-actual concrete individuals and worlds. Rather, they give an account of worlds in terms of their favoured kinds of abstract object. Thus (5) is just as unproblematic for ersatz modal realists as it is for genuine modal realists; the only difference being that each of the ways in which Deep Blue could have won is represented not by some concrete object but by some suitable abstract object, according to which Deep Blue does win that way. We can treat time similarly.

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[9] A similar thing, it seems, can be said in the modal case. Suppose we use 'span$\Diamond$' to span possibilities, then we could write: span$\Diamond$(There are many ways in which Deep Blue wins the chess match) & $\sim\!\Diamond$(There are many ways in which Deep Blue wins the chess match)

[10] See, for instance, Adams (1974), Plantinga (1976) and Stalnaker (1976)

Although I have given such a treatment of the standard tense operators in my (2006), we need to summarise some of the framework here in order to see how the problematic span operators can be added to it.

Let us first introduce the ordered triple $\langle \mathbf{T}, E, t \rangle$, where $\mathbf{T}$ is a set, E is a relation on $\mathbf{T}$, and $t \in \mathbf{T}$. Intuitively, $\mathbf{T}$ is the set of times, E is the 'earlier than' relation, and t is a particular time. I take times themselves to be ordered pairs of the form $t = \langle \mu, n \rangle$,[11] where μ is a set of present-tensed propositions, and n is a number that represents the date at which those propositions are true.[12] Take μ to give a complete representation of what is true at that time. Take E to be a relation between such times. To represent that time is linear, for instance, the E-relation will have, among others, the properties of being irreflexive, asymmetric and transitive. To represent that time is continuous, let $n \in \mathbb{R}$. The ordering of the times by the E-relation from earlier to later will follow the obvious ordering of the dates.

Let us also distinguish truth-at-a-time from truth *simpliciter*.[13] Truth *simpliciter* is an absolute, not time-relative, notion, whereas truth-at-a-time is time-relative: all propositions at a time are true relative to it, but only those propositions which are true at the present time are true *simpliciter*. So, where the propositions involved are any atomic propositions, we have:

(10)   'p' is true-at-a-time $\langle \mathbf{T}, E, \langle \mu, n \in \mathbb{R} \rangle \rangle$ iff $p \in \mu$.

(11)   '$\sim p$' is true-at-a-time $\langle \mathbf{T}, E, \langle \mu, n \in \mathbb{R} \rangle \rangle$ iff $p \notin \mu$.

(12)   '$p \& q$' is true-at-a-time $\langle \mathbf{T}, E, \langle \mu, n \in \mathbb{R} \rangle \rangle$ iff $p, q \in \mu$.[14]

Whereas, for instance:

(13)   'Socrates is sitting' is true *simpliciter* iff Socrates (i.e., a concrete, flesh and blood Socrates) is presently sitting.

The problem for presentism is that past-tensed propositions cannot be true *simpliciter* in the same way that present-tensed propositions can, since to invoke concrete past objects is to give up on presentism. Past-tensed propositions, then, must be treated differently.[15] I propose the following:

(14)   '$\mathbf{P}p$' is true *simpliciter* iff p is a member of a set μ of present-tense propositions that is the first element of an ordered pair $\langle \mu, n_i \in \mathbb{R} \rangle$ E-related to the presently realised ordered pair $\langle \nu, n_j \in \mathbb{R} \rangle$, where ν is the set of present-tensed propositions that is true *simpliciter*, and $n_i < n_j$.

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[11] At least for the purposes of this paper. See fn.15

[12] Both numbers and propositions I take to be abstract objects.

[13] Analogous to Adams (1974) in distinguishing truth-at-a-world from truth *simpliciter*

[14] It should be obvious how to continue for the other truth-functional connectives.

[15] Future-tensed propositions require much more formal machinery than is required for our purposes here, since I take the future to have a branching structure, and so we need to ensure that we choose those times along those branches that correspond to what we would ordinarily call the actual history of the world. For these niceties, see my (2006).

In other words, '$\mathbf{P}p$' is true iff 'p' is true at a time earlier than the present time. Quantified propositions can be dealt with as follows:[16]

(15)   '$\mathbf{P}\forall xFx$' is true at $\langle \mathbf{T}, E, t\rangle$ (and is true *simpliciter* iff the set of propositions at t is true *simpliciter*) iff $\forall xFx$ is true at some time E-related to t, where $\forall xFx$ is true-at-a-time $\langle \mathbf{T}, E, \langle \mu, n\in\mathbb{R}\rangle\rangle$ iff $\forall xFx \in \mu$.

(16)   '$\mathbf{P}\exists xFx$' is true at $\langle \mathbf{T}, E, t\rangle$ (and is true *simpliciter* iff the set of propositions at t is true *simpliciter*) iff $\exists xFx$ is true at some time E-related to t, where $\exists xFx$ is true-at-a-time $\langle \mathbf{T}, E, \langle \mu, n\in\mathbb{R}\rangle\rangle$ iff $\exists xFx \in \mu$.[17]

The idea, then, is that present-tensed propositions are made true by concrete facts, whereas past-tensed propositions are made true by facts concerning appropriately structured abstract objects. Presentism should now be thought of not as the view that only one time exists, but that only one time has a concrete realisation. Since it is the claim that no times other than the present are concrete that matters for being a presentist, presentism should not be characterised as the view that 'only the present exists', since presentists *qua* presentists can believe in much more: having a view about time need not commit you to a view about the ontology of mathematics, for instance. So the view I am sketching here still counts as presentism.[18]

We have now arrived at the stage where we can tackle the more complex s$\mathbf{P}$an operator. To appreciate the strategy, we should break it down into stages. 's$\mathbf{P}$an$^{\tau}p$' is used to quantify over times during the interval τ, and to say that p is true during it. The time interval τ is just a set of E-related times. So to say that p is true during τ is to say that p is a member of the first element of some time during τ. So we have:

(17)   's$\mathbf{P}$an$^{\tau}p$' is true at $\langle \mathbf{T}, E, t\rangle$ (and is true *simpliciter* iff the set of propositions at t is true *simpliciter*) iff p is a member of the first element of some time among those times E-related to t that comprise the interval τ.

It is also straight-forward to formulate truth-conditions for s$\mathbf{P}$an operating on negated propositions, as follows:

(18)   's$\mathbf{P}$an$^{\tau}{\sim}p$' is true at $\langle \mathbf{T}, E, t\rangle$ (and is true *simpliciter* iff the set of propositions at t is true *simpliciter*) iff p is not a member of the first element of some time among those times E-related to t that comprise the interval τ.

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[16] We only need to consider *de dicto* quantified past-tensed propositions here in order to understand the temporal ersatzist position. Although it is commonly thought that presentism cannot deal with *de re* forms, I show how it can in my (2006).

[17] Note that the existential quantifier, here, is read tenselessly, if only because if it were taken to mean *presently exists*, then presentism would be the trivial thesis that only what presently exists, presently exists. Read it tenselessly and it becomes more exciting. The quantifiers should also be read in the standard objectual way. The quantified propositions $\exists xFx$ and $\forall xFx$ themselves are to be given their standard truth-conditions in terms of the satisfaction of the incomplete proposition Fx. Note that the objects that at one time satisfy Fx need not remain in existence for a quantified proposition within a tense operator to be true, as noted above with (7) and (8).

[18] Lewis complains that the difference between abstract and concrete is not clear. I think that all that needs to be said, however, is that the relations that hold at and between concrete times, such as spatio-temporal relations, are entirely different from the sorts of relations that hold at and between abstract times, such as entailment and set-membership.

This is a nice way of proceeding because (17) and (18) allow for a neat way of expressing the idea that *p* is true during all of the interval τ, as follows: ~s**P**an$^{\tau}$~*p*.

Conjunctions, as we have seen, are not always true at particular times, although they could be, so we must say:

> (19)   's**P**an$^{\tau}$(*p*&*q*)' is true at $\langle$**T**, *E*, *t*$\rangle$ (and is true *simpliciter* iff the set of propositions at *t* is true *simpliciter*) iff *p* is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ, and *q* is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ..

The other truth-functional connectives can either be introduced in a similar way, or expressed using (17)-(19). The truth-conditions for quantified propositions falling within the s**P**an operator can be given, as follows:[19]

> (20)   's**P**an$^{\tau}\exists xFx$' is true at $\langle$**T**, *E*, *t*$\rangle$ (and is true *simpliciter* iff the set of propositions at *t* is true *simpliciter*) iff $\exists xFx$ is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ

> (21)   's**P**an$^{\tau}\forall xFx$' is true at $\langle$**T**, *E*, *t*$\rangle$ (and is true *simpliciter* iff the set of propositions at *t* is true *simpliciter*) iff $\forall xFx$ is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ

Temporal intervals, then, seem quite manageable for presentists who treat other times in this ersatz way. Is this, then, to say that we now have a simple way of formulating the correct truth-conditions (and giving the truthmakers) for our problematic (6)? Unfortunately not, for the major problem arises when we introduce identity. Consider the following attempt at formulating the simpler 'There were at least two kings of England' using something along the lines of a combination of (19) and (20):

> (22)   's**P**an$^{\tau}\exists x\exists y((Kx$ & $Ky)$ & $x{\neq}y)$' is true at $\langle$**T**, *E*, *t*$\rangle$ (and is true *simpliciter* iff the set of propositions at *t* is true *simpliciter*) iff $\exists xKx$ is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ, and $\exists yKy$ is a member of the first element of some time among those times *E*-related to *t* that comprise the interval τ, and $x{\neq}y$ is a member…

Something has gone wrong. The variables *x* and *y* float free in '$x{\neq}y$', and any attempt to bind them results in the false claim that these two distinct objects existed at the same time. Another attempt might be to place the burden on the intervals themselves and say that either *they* are identical, in which case '$\exists x\exists y((Kx$ & $Ky)$ & $x{\neq}y)$' can be true at each time during it, or they are not identical (from which it may be hoped we could draw conclusions about the identity of *x* and *y*). But without even attempting to capture the idea that the intervals could partially overlap and include the proposition that $\exists x\exists y((Kx$ & $Ky)$ & $x{\neq}y)$ this strategy, although containing no free variables, does not quite capture that there are at least two kings of England: one interval might begin when the other ends, and yet there might only ever be what we would take to be one thing throughout that satisfies '*Kx*' at each time.

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[19] See fn.17

The difficulty that presentism has with these cases should not, however, be taken to indicate a difficulty with presentism itself. Rather, the real moral we should draw from trying to give an analysis is that such cases involve a hidden complexity. What presentists need to do to offer a satisfactory solution to the problem, then, is to give a general strategy for dealing with the complexity once it has been identified.

The key to a solution is to note that when claims of identity fall within the scope of a span operator it suggests that the identity relation may not be intended *synchronically* but *diachronically*. Given this, it is no wonder that presentism has no easy way to formulate examples such as (6), whereas a realist about other times has no particular difficulty. This is because, for a relation to exist, all of its *relata* must exist; so if the relation is transtemporal, presentists cannot believe in them: if one *relatum* exists, any other non-synchronous *relatum* does not. In other words, this problem is just a special case of a more general problem for presentism, namely how to deal with transtemporal relations. Presentists, unlike realists about other times, cannot believe that there is a genuine identity relation (or, indeed, difference relation) that holds between *relata* located at different times. But this seems to be what is needed to solve the problem of numerical quantification within the s**P**an operator. So what should a presentist do?

We need to say what conditions are required for something to be the same thing over time, and for it to be different from everything else. This is, of course, a controversial issue, but however we fill in the particular details, we should all agree that whether one thing is the same as or different from another thing is something that supervenes on the facts. Of course, this is not saying much until we know what the facts are taken to be, but if we can show that such facts need not require transtemporal relations, then presentism is home and dry.

Let us consider what it takes to be one king of England named Edgar. The natural way of understanding this is as invoking an object that lasts for longer than an instant; so one requirement is for the proposition that there is one king of England named Edgar to be true at particular times during some interval. However, since this is compatible with there having been more than one king of England named Edgar during this time, we have to tie together all of the things who at particular times during the interval are kings of England named Edgar to form one integrated king of England who lasts the duration of the interval. Let us call whatever it is that holds between these things the '*R*-connection', such that, according to it, we have one thing. There is disagreement over whether and to what extent the *R*-connection involves psychological continuity, or bodily continuity, or whatever, but the important point is that the *R*-connection consists of various facts concerning various states of the things (psychological, physiological, whatever) that hold at particular times, together with an appropriate causal connection between the facts concerning those states of the thing at those times. (We may also need to include the fact that there exists no other candidate for being that thing at a given time, otherwise it may be thought to be indeterminate which thing the thing is, if any, and so how many such things exist during this interval.[20])

Some might object that if the *R*-connection involves causation, then presentism cannot help itself to this strategy, since the causal relation here is itself transtemporal. But all that presentists need to deny is that causation is a genuine relation, and adopt a view of causation that does not rely on that assumption. This manoeuvre comes at no great cost, since many popular theories of causation do not treat causation as a genuine relation; both the regularity and counterfactual theories, for instance, express causal statements in terms of connectives not relations. So, if causation should be best thought of as a connection between facts rather than as a relation between events,[21] presentism can unproblematically use the notion of the *R*-connection,

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[20] *Pace* Bernard Williams. See, for instance, Parfit (1984)
[21] See, for instance, Mellor (1995)

since no transtemporal relations are involved in it, and all the facts that are involved can be represented in the ersatz way.[22]

What it is to be a single thing, then, supervenes on the *R*-connected facts. Or more accurately, in order to guarantee that we do not miscount the number of things, we should say it supervenes on what we may call 'closed *R*-connected facts', where the facts are *R*-connected to each other and there is no other fact to which they are *R*-related. We can now use this to say what it takes for something to be different from something else. For the number of things that exist supervenes on the *R*-connected facts: one thing is different from another if the closed *R*-connected facts concerning one thing are different from the closed *R*-connected facts concerning the other. So to say that there are exactly two kings of England named Edgar is to say that there are two different lots of closed *R*-connected facts, F_1, F_2, concerning a king of England named Edgar, and every lot of closed *R*-connected facts concerning a king of England named Edgar is identical to either F_1 or F_2.

An account of the difference relation required to solve the problem of numerical quantification within the s**P**an operator can be given, then, without invoking a genuine transtemporal relation, since it supervenes on the facts, i.e., what is represented as being the case according to the abstract structure. Presentism, then, survives. And it survives in a more transparent and satisfactory form than the version that takes (7a) as a primitive truth. Indeed, the complexity that we have seen is involved in (7a) is a strong reason to think that we do not have a primitive understanding of it. On the other side of the fence, those who take other times to be real may think that their account of (7a) is much less involved than the solution I have just sketched, and so preferable. But this would be a misleading impression of the situation. After all, in order for realists to quantify over the right sorts of thing, a story along the lines of closed *R*-connected facts is the best story to be told in any case, otherwise (7a) may well be true without there having been two kings of England named Edgar, since there is nothing to say that the variables do not just pick out various portions of a single object. There is not much to choose, then, between the ersatz view and the realist view in terms of the complexity of what needs to be in place to capture claims like (6); the only substantial difference is that realists invoke concrete facts as truthmakers, whereas presentists invoke abstract truthmakers. At this stage, then, the only ammunition that realists have against ersatzers is the problem familiar from the modal realism debate of accounting for how abstract objects manage to represent how things are. This general issue goes beyond the scope of our concerns here, but it is worth commenting that, even if we were ultimately left with some 'magical' account of how representation is achieved, there would be a strong defensive strategy presentism could employ, namely that if the realists won't allow such accounts of representation, then they will be forced into an uncomfortable position in accounting for representation in the modal case, either by going to the one extreme of adopting the analogue of their view of time and endorsing genuine modal realism and concrete representations, or by going to the other end of the scale and adopting an unenlightening primitivism. But however this wider story pans out, I've shown that presentism need not worry about the particular problem of numerical quantification across temporal intervals.

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[22] See my (2006) for the details of this project to show how presentism deals with causation.

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