Bound Tense in Relative Clauses: Evidence from VP-ellipsis*

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1 Introduction

We discuss lessons from VP-ellipsis about Tense Embedding (TE). We begin by portraying two possible views of Relative Clause TE (RC-TE): one that derives simultaneous readings only by coreference; the other by binding (Section 2). We show data from VP-ellipsis, inspired by Stowell 2014, that support the binding view (Section 3), and later review an argument that has been made against it (Section 4). The argument is based on the behavior of so-called defective modals in TE, and was articulated by Abusch (1994) and von Stechow (1995). In our evaluation of Abusch/von Stechow's argument we will claim that their conclusion about RC-TE was unwarranted, and that their data can be explained independently of RC-TE binding question. Nevertheless, we draw attention to another potential challenge to binding accounts of RC-TE simultaneity, leaving the question unresolved (Section 5).

2 Tense embedding and simultaneity

2.1 Background

To begin, consider the example of RC-TE in (1).

(1) John worked for a man who sold bibles (RC-TE)

(1) allows at least two readings, back-shifted, and simultaneous. The two readings share the requirement that John's employment precede the utterance time, but they differ on when, relative to that employment, John's boss is understood to have sold bibles. On the back-shifted reading, the bible-selling precedes the (already anterior) employment, and on the simultaneous reading they are contemporaneous.[1]

There are several ways of thinking about (1)'s apparent ambiguity, but limitations of space restrict our review to (sketches of) two perspectives. Before we discuss

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[1](1) also allows a forward-shifted reading. We mostly ignore it here as it is not relevant for our discussion.

them, we take a moment to explain our principal theoretical assumptions. We must emphasize that these assumptions are not part of a novel system that we wish to propose. We use them simply to clarify our description of the relevant problems, and possible solutions.[2]

First, we adopt a pronominal treatment of tense (Partee 1973 a.o.), and assume representations where tense morphemes are indexed. The indices are mapped contextually to time intervals but only if the interval satisfies the requirements of the tense morpheme. For example, PAST_i is mapped to $g(i)$ provided that $g(i)$ precedes the local time of evaluation; PAST_i is otherwise undefined (see Heim 1994):

(2) $[\![\textbf{PAST}_i]\!]^{g,w,t} = g(i)$ only if $g(i) < t$; undefined otherwise

Second, we add an unusual (though innocuous) semantic rule that composes nodes of the form $\textbf{[T}_i\ \textbf{S]}$, i.e. nodes that have a tense morpheme as one daughter, and a node of type t as the other. The rule's output is $[\![\textbf{S}]\!]^{[\![\textbf{T}_i]\!]}$, that is, the interpretation of node **S**, but with the denotation of its sister node **T** as the time parameter. We call this rule Tense Anchoring:

(3) **Tense Anchoring (TA)**[3]
For any node $\textbf{[T}_i\ \textbf{S]}$, where $\textbf{T}_i$ is a tense morpheme and **S** a node of type t, $[\![\textbf{T}_i\ \textbf{S}]\!]^{g,w,t} = [\![\textbf{S}]\!]^{g,w,[\![\textbf{T}_i]\!]^{g,t}}$ — more compactly: $[\![\textbf{T}_i\ \textbf{S}]\!]^{w,t} = [\![\textbf{S}]\!]^{w,i}$

As a simple example we show the composition of the sentence **John sold bibles** below: w_0 is the evaluation world and u is the utterance time. We abbreviate $g(i)$ as i from now on.

(4) $$[\![\textbf{PAST}_i\ \textbf{John sell bibles}]\!]^{w_0,u} = [\![\textbf{John sell bibles}]\!]^{w_0,[\![\textbf{PAST}_i]\!]^u}$$
$$= [\![\textbf{John sell bibles}]\!]^{w_0,i} \text{ as long as } i < u$$

We now return to (1). Our main concern in this paper is simultaneity in RC-TE, and specifically whether binding might be one of its possible sources. For this reason we will describe with minimal detail the kind of view that derives simultaneity in RC-TE simply from coreference (between e.g. the two PASTs in (1)), and contrast it with the kind of view that allows simultaneity to result also from binding.

2.2 Simultaneity by coreference

Consider the following LF for (1):

(5) [PAST_i [John work for [a man who$_{\lambda y}$ [$\text{PAST}_{\#i/j}$ [t_y sell bibles]]]]]

[2]For more representative reviews of the literature we refer our readers to Stowell 2007, Ogihara 2011, Ogihara and Sharvit 2012, Sharvit to appear, and references therein.

[3]Note that the effect of TA can be achieved without it; we can assume an optional type-lifting of tense pronouns ($s \Rightarrow \langle st, t\rangle$), and the lift, together with Intensional Functional Application (IFA), reproduces TA.

In (5) the two occurrences of PAST stand in a c-command relation. This (as the reader can verify) has consequences on how the two morphemes may be indexed: the higher PAST requires that i precede u, and by TA, the rest of the LF (including the lower PAST) is interpreted relative to i. The lower PAST, in turn, has an anteriority requirement of its own, namely that *its* index precede the temporal parameter i. Therefore the lower PAST cannot carry index i (as i cannot precede itself), and its index (call it j) must point to an earlier temporal interval than the higher i. The LF (5) is therefore unambiguously back-shifted.

But (5) is not the only LF that sentence (1) can have. Coindexation, and therefore simultaneity, *can* result if the DP that hosts the RC is interpreted above the matrix PAST:

(6) [[a man who$_{\lambda y}$ [PAST$_{i/j}$ [t_y sell bibles]]] λx [PAST$_i$ [John work for t_x]]]

In (6) neither occurrence of PAST is in the scope of the other, so no anteriority needs to hold between their referents. When the two morphemes are coindexed, we derive the simultaneous reading, and when they are counterindexed, we derive the back-shifted or the forward-shifted reading, depending on how the indices are ordered relative to one another.[4]

2.3 Simultaneity by binding

Our presentation of binding accounts of simultaneity is based on von Stechow (1995) and Kratzer (1998). The two main ingredients are (i) "zero-tense", and (ii) feature-deletion.

By zero-tense we mean a vacuous index ($\varnothing$) that accompanies ordinary tense morphology: $\varnothing$ is "vacuous" in that it refers to the temporal parameter used in its interpretation:

(7) $[\![\mathbf{T}_\varnothing]\!]^{w,t} = t$, provided that the requirements of **T** (the tense morpheme) are met

The reader may now notice that PAST$_\varnothing$, on current assumptions, cannot possibly have an interpretation: by the semantics of PAST, $[\![\mathbf{PAST}_\varnothing]\!]^{w,t}$ must precede t, but by the semantics of $\varnothing$, $[\![\mathbf{PAST}_\varnothing]\!]^{w,t}$ is t itself. This brings us to our second ingredient. Following Ogihara (1989/1996), von Stechow posits a morphosyntactic rule that deletes the features on a tense morpheme when it is locally c-commanded by another instance of the same morpheme.

[4]We must note that QR is not the only way of pulling an embedded tense out of the scope of another. One could alternatively enrich the pronominal entry on each tense, assigning not only a "referring" index but also a perspective index (see e.g. Kusumoto 2005 and Ogihara and Sharvit 2012).

(8) **Sequence of Tense (SOT) rule**:[5] $[\mathbf{T_1}\ [\cdots\ \mathbf{T_2}\ \cdots]] \Longrightarrow [\mathbf{T_1}\ [\cdots\ \sout{\mathbf{T_2}}\ \cdots]]$, *optionally*, if $\mathbf{T_1}$ and $\mathbf{T_2}$ are instances of the same tense morpheme, and no other tense morpheme $\mathbf{T_3}$ c-commands $\mathbf{T_2}$ and is c-commanded by $\mathbf{T_1}$.

The SOT rule gives us the following LF:

(9) [PAST$_i$ [John work for [a man who$_{\lambda y}$ [$\sout{\text{PAST}}_{\varnothing}$ [t_y sell bibles]]]]]

With (9) as a possible LF for (1) we now have yet another way of deriving (1)'s simultaneous reading: the bible-selling is anchored to a "fake" tense $\varnothing$, and the fake tense is bound by the matrix PAST$_i$, i.e. the time of John's employment.

These are our summaries of the first two accounts of RC-TE: on one of them simutlaneity is a product of coreference, and on the other it results (also) from binding. In the next section we present an argument from VP-ellipsis that supports the binding view, and in Section 4 we describe (and critique) Abusch's/von Stechow's argument against it.

3 In favor of binding in RC-TE: VP-ellipsis

Although the exact conditions on VP-ellipsis are not fully understood, and semantic as well as syntactic factors are thought to be at play, for current purposes we will assume the following semantic-identity condition on VP-ellipsis:[6]

(10) **Condition on VP Ellipsis**:
An elided VP_E must be semantically-identical to a discourse-salient antecedent VP_A, where VP_E and VP_A are semantically identical iff for any combination of interpretational parameters g, w, t, $[\![\mathbf{VP_E}]\!]^{g,w,t} = [\![\mathbf{VP_A}]\!]^{g,w,t}$.

3.1 VP-ellipsis and doubly-simultaneous readings

Our argument in this section is inspired by Stowell 2014. Consider the following elliptical example, with (10) as background.

(11) John works for a man who sells bibles. His grandfather did too.

(11) can be understood to say that John now works for a man who (now) sells bibles, and that his grandfather in the past worked for a man who *then* sold bibles. We will

[5] Strictly speaking, we need not commit to a deletion rule. The binding account can be formulated with zero-tenses that have no features, but that *inherit* features through a process of agreement. In this respect zero-tenses behave similarly to zero-pronouns (see Kratzer 1998 for a thorougher discussion).

[6] We are aware that this condition is insufficient for a general theory of VP ellipsis. This formulation suffices for our purposes, however, in part because our representation of binding—using zero pronouns—may not require rebinding-ready mechanisms along the lines of e.g. Takahashi and Fox 2005. Moreover, as we later show, the interaction between RC-TE and VP-ellipsis resembles the interaction between pronoun interpretations and ellipsis. We are thus fairly confident that reformulations of (10), if motivated by the behavior of pronouns, will be applicable to tenses as well.

call this reading *doubly-simultaneous*, since both clauses that comprise the example take the simultaneous reading, but each clause is anchored to a different time (present and anterior in (11)). Now, if we assume the identity condition in (10), then the missing VP in (11) must have the same interpretation as the VP **work for a man who sells bibles**, which contains an occurrence of the simple present. On the non-binding view sketched above, this occurrence of PRES cannot be the realization of a zero-tense, so the elided VP in (11) should mean that John's grandfather worked for a man who *now* sells bibles, and this is not the doubly-simultaneous reading we want.[7] On the other hand, if RC-TE *does* license zero-tenses, then we expect LFs like (12) to be licit, and therefore predict (correctly) that (11) have the doubly-simultaneous reading.

(12) John PRES work for a man who ~~PRES~~$_{\varnothing}$ sell bibles.
His grandfather PAST (did) ⟨work for a man who ∅ sell bibles⟩ too.

Below we add more examples that illustrate the same point. (13) is similar to (11), but here the antecedent VP is embedded under PAST, not PRES, and the elided VP is embedded under PRES. Double-simultaneity is available in this case also; the sentence can mean that John worked for a bible-salesman, and that his son now works for a bible-salesman.

(13) John worked for a man who sold bibles. (And now) his son does
John PAST [work for a man who ∅ sell bibles].
His son (does) PRES ⟨work for a man who ∅ sell bibles⟩

Here is another example. The sentence in (14) is felicitous only if a doubly-simultaneous reading is assumed, since otherwise, the occurrence of PRES inside the elided VP requires that former Europeans be alarmed by *current* fascist trends (a similar problem arises if the indefinite **political campaigns...** is interpreted above matrix tense).

(14) Many Americans are alarmed by political campaigns that promote fascism.
In the thirties many Europeans were too.

And once again, we find the same "sloppy" reading if we reverse PAST and PRES:

(15) In the thirties, many Europeans were alarmed by campaigns that promoted fascism. And these days many Americans are.

In the next section we expand on this paradigm, and show that these doubly-simultaneous readings follow patterns that match those of sloppy readings of pronouns. We take this to strengthen the possibility that, whatever binding mechanism underlies sloppy interpretations of pronouns under VP-ellipsis, a very similar mechanism produces the doubly-simultaneous readings shown above.

[7] In English, PRES is "absolute"; under PAST in RC-TE, it is fixed to utterance time (see Ogihara and Ogihara & Sharvit for discussion). For example, (1) is false at u if John's ex-boss does not sell bibles at u.

(1) John worked for a man who sells bibles

3.2 Two constraints on sloppy readings and doubly-simultaneous readings

It is well known that sloppy readings of elided person pronouns are constrained. Analyzing double-simultaneity (as we have done) as resulting from binding should in principle show similar constraints as those that limit the range of sloppy identity for pronouns. In this section we confirm this with two kinds of data, both blocking sloppy readings of person pronouns, and (in parallel) blocking doubly-simultaneous readings of RC-TE. The comparison is intended to show that simultaneity does not result from a relaxation of the ellipsis constraint, but seem to conform to generalizations that are familiar from pronoun ellipsis.

3.2.1 Witten's paradigm

Our first example concerns a contrast between elided person pronouns on the one hand, and demonstrative DPs on the other. In designing this example we draw on an asymmetry between pronouns and proper names in permitting sloppy readings (Witten 1970). To see this, observe first that in (16), the referent i can be thought by i's mother to be the smartest in i's class, and that *Bill* can be thought by Bill's mother to be the smartest ('sloppy' is possible with pronominal antecedent).

(16) His$_i$ mother thinks he is the smartest in the class. And Bill's mother does too.

Note that **his**/**Bill** does not c-command into the VP here, so it isn't clear what the relevant binding relation needs to be in order for the sloppy reading to come out (this will come up again in Section 6). But for now, this lack of c-command is not relevant. What matters is that this sloppy reading, wherever it comes from, is absent from the minimally-different (17), where the VP includes a name instead of a pronoun: Assuming that **his** is used deictically to refer to John, (17) can have the strict reading, where Bill's mother thinks that *John* is the smartest, but not the sloppy reading where she thinks that *Bill* is the smartest ('sloppy' is not possible with a proper-name antecedent).

(17) His$_j$ mother thinks John is the smartest in the class. And Bill's mother does too.

We are interested in testing this on RC-TE, but because of the difficulty in finding tense 'names', we will show first that the Witten findings do not change when we have demonstrative antecedents instead of names. The example is shown in (18).

(18) His$_i$ mother thinks that this boy$_i$ is the smartest in the class.
And Bill's mother does too. (*sloppy)

We conclude, on the basis of (16-18), that antecedent VPs containing pronouns allow sloppy readings of ensuing elided VPs, but antecedent VPs containing names or demonstratives do not. We now show a similar block on doubly-simultaneous readings in RC-TE. Consider the discourse in (19):

(19) John works for the channel that broadcasts the presidential debates.
Twelve years ago, Bill did too.

The speakers we consulted allow a reading of (19) where John's company and Bill's company are different. If right, this means that (19) permits the doubly-simultaneous reading, as expected given our previous examples. Crucially, however, adding a demonstrative in the antecedent VP, as in (20-21), blocks double-simultaneity (unless the company is understood to be the same, in which case the referent of the objects in both VPs would be identical and would thus satisfy the condition on ellipsis).

(20) John works for the channel that broadcasts this year's presidential debates.
Twelve years ago, Bill did too.

(21) John works for the channel that broadcasts the presidential debates this year.
Twelve years ago, Bill did too.

The interference of demonstratives in (20-21) parallels that in (18), showing a similarity between the distribution of sloppy readings of pronouns, and the distribution of doubly-simultaneous readings in RC-TE.

3.2.2 Dahl's paradigm

Our second group of cases are examples of what is currently known as Dahl's Puzzle (Dahl 1973). The reported judgement in the literature is that cases like (22), where the antecedent VP contains two potential bindees, allow for only three of the four logically possible readings: sloppy-sloppy, strict-strict, and sloppy-strict; strict-sloppy is disallowed.

(22) Al thinks that he is doing everything for his kids. Ed does too.
✓(sloppy-sloppy) Ed does ⟨think ED is doing everything for ED's kids⟩
✓(strict-strict) Ed does ⟨think AL is doing everything for AL's kids⟩
✓(sloppy-strict) Ed does ⟨think ED is doing everything for AL's kids⟩
∗ (strict-sloppy) Ed does ⟨think AL is doing everything for ED's kids⟩

While we remain agnostic about what exactly explains the pattern in (22), we point out that an analogous paradigm is found for double-simultaneity. In (23-24), simultaneity in the elided clause cannot hold between the matrix (binding) tense and the deepest tense morpheme, unless it also includes the intermediate tense morpheme. In the right margins below, we use 'sim' to indicate simultaneity with the embedding tense binder, and 'non' to indicate nonsimultaneity.

(23) Al thought that Sue was hiring actors who were famous. Now Ed does.
a. Ed does ⟨think that Sue IS hiring actors who ARE famous⟩ (sim-sim)
b. Ed does ⟨think that Sue WAS hiring actors who WERE famous⟩ (non-non)
c. Ed does ⟨think that Sue IS hiring actors who WERE famous⟩ (sim-non)
d. *Ed does ⟨think that Sue WAS hiring actors who ARE famous⟩ (non-sim)

Both (23a) and (23b) are possible readings of the elided VP in (23). (23c) is also available: for example, if both Al and Ed think that Sue makes shows about "has-beens", Al having thought this in the past, and Ed thinking it in the present. However, there seems to be no context that makes the (23d) reading available, in parallel with the absence of the strict-sloppy reading for elided pronouns. A similar effect is seen in (24).

(24) Al thought that Sue lived in a city where smoking was illegal. Now Ed does.
   a. Ed does ⟨think S LIVES in a city where smoking IS illegal⟩ (sim-sim)
   b. Ed does ⟨think S LIVED in a city where smoking WAS illegal⟩ (non-non)
   c. Ed does ⟨think S LIVES in a city where smoking WAS illegal⟩ (sim-non)
   d. *Ed does ⟨think S LIVED in a city where smoking IS illegal⟩ (non-sim)

Our point in discussing these Dahl-like examples (and the Witten-like ones) is to show that what we took to suggest tense-binding appears to resemble familiar cases of (and constraints on) pronoun binding, as demonstrated by sloppy readings of VP-ellipsis.

4 Against binding in RC-TE: *ought*, and a reassessment

As mentioned in the introduction, Abusch and von Stechow (A/vS) have argued that simultaneity in RC-TE cannot come from binding. To understand the argument, we need to compare the behavior of RC-TE to that of AV-TE. Consider (25):

(25) John thought that Mary sold bibles

Like the RC-TE example in (1), (25) also allows a simultaneous and a back-shifted reading. With the simultaneous reading in mind, consider the two LFs in (26):

(26) a. [PAST$_i$ John believe [PAST$_i$ Mary sell bibles]] (coreference?)
   b. [PAST$_i$ John believe [~~PAST~~$_\varnothing$ Mary sell bibles]] (binding)

On current assumptions, (26a) is predicted to be inconsistent: as we saw earlier, if an occurrence of PAST c-commands another coindexed PAST, the resulting truth conditions will not be satisfiable. When we saw this problem in RC-TE we also noticed that QR can make coindexation possible (recall (6), and recall also that QR is not the only way of achieving transparency for tense). Here, however, a transparent interpretation of the embedded tense pronoun (e.g. via QR) is not only unlikely, but as von Stechow points out, it also produces incorrect truth conditions: the resulting reading requires that at some earlier time i, John believe that at i Mary sell bibles. But Mary's bible-selling is not thought (by John) to take place at i; it is thought to take place at John's *perceived present* at i. The temporal location of the embedded proposition should therefore be bound not to the matrix tense, but to the attitude holder's "now" at the time denoted by it. This desired reading is exactly what results from LF (26b):

(27) $[\![\textbf{believe}]\!]^{w,t} = [\lambda p_{\langle s\times s,t\rangle} \,.\, \lambda x_e \,.\, \text{BEL}_{x,w,t} \subseteq \{\langle w', t'\rangle \,:\, p(w', t') = 1\}]$

(28) $[\![\textsc{past}_i$ **J believe [**~~**past**~~$_\varnothing$ **M sell bibles]**$]\!]^{w,u}$

$= [\![$**J believe [**~~**past**~~$_\varnothing$ **M sell bibles]**$]\!]^{w,i}$ (by TA; $i<u$ by PAST)

$= [\![$**believe**$]\!]^{w,i}([\lambda\langle w',t'\rangle.[\![$~~**past**~~$_\varnothing$ **M sell bibles**$]\!]^{w',t'}])([\![$**J**$]\!])$ (by IFA)

$= [\![$**believe**$]\!]^{w,i}([\lambda\langle w',t'\rangle.[\![$**M sell bibles**$]\!]^{w',t'}])([\![$**J**$]\!])$ (by TA and def. of $\varnothing$)

$= 1$ iff $\textsc{bel}_{j,w,i} \subseteq \{\langle w',t'\rangle : [\![$**M sell bibles**$]\!]^{w',t'} = 1\}$

To A/vS, this means that only zero-tenses can appear in the scope of intensional predicates.[8] But A/vS go further and ask whether intensional embedding is the *sole* licenser of tense-binding. We will now see why they concluded that the answer is yes.

The contrast that distinguishes AV-TE from RC-TE, to A/vS, is exemplified in (29).

(29) a. John believed that Mary ought to study hard (✓simultaneous)

b. John had a student who ought to study hard (*simultaneous)

(29a) reportedly allows for a simultaneous reading that is similar to (25)'s: at some earlier interval i John believed that *at his perceived present* Mary needed to study. The availability of this reading suggests that **ought** has a "zero" temporal index, and by the same derivation as in (28) that zero-index will make the simultaneous reading of (29a) possible. Similar facts hold of other modals, e.g. **should** and **might**:

(30) a. John thought that Mary should go to the dentist (✓simultaneous)

b. John thought that Bill might be at home (✓simultaneous)

But (the argument goes) if zero-tense binding were possible in RC-TE, then examples like (29b) should give rise to simultaneity, in the same way *mutatis mutandis* as (29a,30). But (29b) does not allow a simultaneous reading, leading Abusch and von Stechow to conclude that zero-tenses cannot be bound in RC-TE.

However, we believe that the asymmetry in (29) can be due to a lexical property of **ought** itself (and similar modals), rather than a difference in the distribution of zero-tense or tense binding. We see two ways of expanding on this. One possibility is that **ought** has a subjunctive use, and also an indicative use. Subjunctive **ought** only appears in intensional environments (e.g. under AVs), and it has a zero-tense argument. Indicative **ought** is licensed outside the scope of AVs, but its temporal location is always fixed to the time of utterance (like PRES). This, though far from fully developed, provides a way of capturing the AV/RC-TE difference: in AV-TE an embedded **ought** (which may be subjunctive) tolerates simultaneity with an embedding PAST, because its zero-tense argument is anchored within the embedded proposition (recall (29a)); in RC-TE, only indicative **ought** is licensed, and for this reason sentences like (29b) do not permit past-shifting. Another, more principled explanation is that **ought**'s temporal anchor is *perspectival*, and can be "bound" only

[8] The reader may wonder how back-shifting in AV-TE can be derived with zero-tenses. Setting detail aside (given that our main concern is simultaneity), one possibility is to add a non-pronominal, quantificational entry for PAST (see e.g. Ogihara 2011), which in an intensional context existentially introduces an anterior time that verifies the embedded proposition. Another (due to Kratzer) is to derive back-shifting through embedded aspect operators.

to the temporal anchor of a logophoric center. When **ought** appears in the scope of an AV, the attitude holder's 'now' serves as binder, but in the absence of an AV, as in the RC-TE (29b), only the speaker's 'now' (the utterance time) may fix **ought**'s time argument.[9]

Both of these possibilities are compatible with an account that licenses zero-tense binding in RC-TE. The proposal that emerges from this must therefore distinguish the mechanism that binds embedded tense morphemes in RC-TE, from that which assigns a temporal anchor to **ought** and its sister modals. We now turn to the data that keep us from arguing in favor of binding in RC-TE with full confidence.

5 Semantically-future PAST in RC-TE?

The following famous example (based on Abusch 1997, in turn on Kamp and Rohrer 1984) shows that instances of morphological PAST may have denotations that *follow* utterance time, and that their presence requires a licensing PAST:

(31) A week ago, John said that in 10 days he would tell his mother that they were having their last meal together

The underlined occurrence of PAST is clearly not intended to refer to a prior interval: the reported last meal is anchored to a time that follows the utterance time, and also follows John's perceived present at the time of his statement.

According to Abusch-style theories of tense, (31) is acceptable because of the PAST marking on the AV **say**, and the licensed PAST-marking on **would**: the occurrence of PAST on **say** licenses the deletion of PAST features on **would**, which in turn licenses the deletion of PAST on **be having**. This is shown in the LF in (32).

(32) [PAST$_i$ John say [he ~~PAST~~$_\varnothing$ will tell his mother [~~PAST~~$_\varnothing$ [they be having $\cdots$]]]]

Now, if the "fake" PAST in (31) is the realization of a zero-tense, and if zero-tenses were licensed across RC boundaries (as we have argued), we expect for there to be well-formed analogs to (31), but where the zero tense is separated from its licensing PAST not by an AV, but by an RC boundary. But this seems to be unsupported, as the oddness of (33) shows.

(33) #A week ago, John saw a car that was going on sale 10 days later at a show where the manufacturer was keen to display its recent models

Speakers seem to agree that (33) is odd, but if RC-TE constructions allowed zero-tense binding (as suggested by the VP-ellipsis facts), we expect the LF in (34) to be well-formed, and therefore that (33) allow an interpretation where the manufacturer's keenness is concurrent with the (future) car show:

(34) PAST$_i$ [John see a car [that ~~PAST~~$_\varnothing$ be going on sale $\cdots$ [~~PAST~~$_\varnothing$ be keen $\cdots$]]]

[9]Indeed, von Stechow himself discusses a perspectival analysis of **ought** in later work (von Stechow 2002), though he does not consider its implications to the RCTE binding question.

From a binding point of view, the unacceptability of (34) is puzzling, and at the moment we leave it unsolved. However, we wish to point to a judgement that may suggest a possible explanation. It has been reported in the tense literature that **would** is constrained in its forward-shifting capacity.[10] For example, the Kamp/Vlach sentence in (35) requires the presidency to precede utterance time, which is unexpected if **will** simply quantifies over posterior time intervals.

(35) Mary met a man who would become president

The importance of this is the following: by its design, sentence (33) has a semantically-future (i.e. post-utterance) PAST-marker on **be keen**. The observation about (35) is that the presidency cannot be post-utterance. It is possible, then, that the constraint responsible for the observation about (35) is at play in (33), namely in requiring both the car show and the concurrent keenness to precede utterance time. If this is right, it follows that (33) is not a true parallel to Abusch's (31), and therefore that a binding account of RC-TE simultaneity is in principle possible. Having said this, we suspect that **was going** and **would** have different properties that could break the connection between (35) and (33). If **would** and **was going** only embed pre-utterance events, we expect (36a) and (36b) to be equally bad:

(36) a. (?) Yesterday, John saw a car that would go on sale 10 days later.
b. (?) Yesterday, John saw a car that was going on sale 10 days later.

From the judgements we have elicited it is not yet clear whether (and how) these two sentences differ. If (36b) is clearly bad, then we can conclude that (33) has an independent (if unclear) property that stops it from allowing the predicted simultaneity, which in turn shows that (33) does not in fact bear on the RC-TE binding question. If not, (33) would stand as a challenge to binding accounts of RC-TE.

6 Closing remarks and remaining issues

We have used ellipsis data to show that embedded tenses, in RC-TE specifically, can have "sloppy" readings. We took this to show that binding between higher and lower tenses in RC-TE is needed, *pace* claims to the contrary by Abusch and von Stechow.

There remain many unresolved issues. First, a VP in a PAST>PAST configuration can allow a back-shifted reading and serve as antecedent to an elided VP that also allows back-shifting. Importantly, the embedded tenses in these cases do not need to corefer:

(37) John lived in a town where Dutch settlers lived. Mary did too.

(37) can be said truthfully even if John and Mary lived in different towns, and even if the two towns were inhabited by settlers at different times. On a pronominal approach this means that the index in the antecedent VP must differ from that of the elided VP, thus failing semantic identity. Examples of this kind can be captured if PAST is

[10] See for example Heim 1994, citing personal communication with James Higginbotham. We thank Philippe Schlenker for discussion of this point.

also given a quantificational entry (see footnote 8), but we leave the details to another occasion.

Another issue is that our doubly-simultaneous readings can be replicated in constructions where the zero-tense is not c-commanded by its binder, as in (38).[11]

(38) The house Sue lives in was owned by a gangster who is serving a jail sentence. The house Bill lived in was too.

The judgement here is subtle, but (38) seems to allow a reading where the time of Bill's stay (in the past) coincided with the jail term of the house's (ex) owner. This would be predicted if binding/deletion were possible from the bolded positions below, but on our current assumptions they are not.

(39) [The house **PRES** Sue live in] was [owned by a gangster who ~~**PRES**~~$_{\varnothing}$-be serving a jail sentence].
[The house **PAST** Bill live in] was ⟨owned by a gangster who ∅-be serving a jail sentence⟩ too.

We do not yet have an account of cases like (38), though we note that there is a parallel between them and cases of so-called "paycheck" pronouns, e.g. (40).

(40) People who live in London worry about its property prices. People who live in NYC do too.

In (40) the sloppy reading in the elided VP seems to be available, even though the name **London** does not c-command into the VP and therefore is not a syntactic position to bind what one might analyze as a zero pronoun. This is parallel to the simultaneity that (38) allows, suggesting yet deeper connections between tenses and pronouns (in the spirit of Partee 1973, Kratzer 1998, and others). The case of (38) specifically motivates a serious consideration of a dynamic account of tenses (e.g. Kamp and Reyle 1993), or perhaps 'e-type' accounts of bound pronouns (and here tenses), where bound variables are treated as abbreviated definite descriptions (e.g. Evans 1980). We leave this to future investigation.

Finally, we note that our main point against coreference accounts hinges on a particular theory of VP-ellipsis, which may be given an alternative dynamic analysis (e.g. Hardt 1999).[12] We leave it to future work to investigate how a theory like Hardt's may be used to account for our ellipsis facts, and whether the account might rid the framework of zero-tenses/binding and instead derive "sloppy" readings using what Hardt calls "center-shifting".

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[11] We thank Yasu Sudo for pointing this out to us.

[12] We owe this observation to an anonymous reviewer of WCCFL34.

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