

Discourse transparency and the meaning of temporal locating adverbs

Daniel Altshuler

Abstract This paper proposes that a core semantic property of temporal locating adverbs is the ability (or the lack thereof) to introduce a new time discourse referent. The core data comes from *that same day* in narrative discourse. I argue that unlike other previously studied temporal locating adverbs—which introduce a new time discourse referent and relate it to the speech time or a salient time introduced into the discourse context—*that same day* is ‘twice anaphoric’, i.e. it retrieves two salient times from the input context without introducing one of its own. Moreover, I argue that the adverb *currently* is like *that same day* in not introducing a new time discourse referent. Unlike *that same day*, however, *currently* has both a deictic and an anaphoric usage analogous to *on Sunday*. The analysis that I propose is implemented within Compositional Discourse Representation Theory. It illustrates how adverbial meaning can be integrated within a more general theory of temporal interpretation.

Keywords Adverbs · Anaphora · Indexicality · Deixis · Tense · Aspect
Compositional Discourse Representation Theory

1 Introduction

This paper is about the meaning of *temporal locating adverbs*: those adverbs whose semantic function is to specify the temporal location of a given eventuality (Kamp 1999/2013). This includes adverbs that specify a unique location like *on June 13, 1985* or ones that simply put bounds on it, as with ‘frame adverbs’ like *in June*, *at noon* or *on Sunday* (Partee 1984).¹ Temporal locating adverbs differ in whether they can be used deictically, anaphorically, neither way or both ways.² Comparing the discourse in (1)

¹ Quantificational phrases like *Every day in June* are also temporal locating adverbs. They are interesting because they raise non-trivial questions about how adverbial meaning is composed and interact with other temporal expressions as well as quantification (see e.g. de Swart 1993, Pratt & Francez 2001, von Stechow 2002, Schaden forthcoming). This paper does not have much to offer in this respect.

² Cf. Vegnaduzzo (2001), who classifies temporal locating adverbs as being *inherently deictic*, *inherently anaphoric* or *contextually anaphoric*. Rathert (2012), on the other hand, calls these adverbs *positional*, and distinguishes between *anaphoric*, *deictic* and *clock-calendar* usages; she treats adverbs of quantification as a separate class. Schaden (forthcoming) call these adverbs *localising temporal expressions* and makes a three way distinction: punctual vs. durative, anaphoric vs. deictic, quantificational vs. non-

below to those in (2)-(5) helps to illustrate these distinctions. In (1), the adverbless clauses—taken from the middle of a story—exemplify *narrative progression*: the temporal location of each described event depends on the temporal location of the previous event and the times of the described events correlate with the order of appearance.

- (1) a. ...Sue gave Fido a bath and cleaned our house.
 b. My wife hired her and gave her a check for one month in advance...

In (2) below, the times of the described events also correlate with the order of appearance. However, unlike in (1)b, the temporal location of the hiring event described in (2)b does not depend on the discourse context. We infer that the hiring took place the day prior to the speech time regardless of (2)a. For this reason *yesterday* is typically called a *deictic* adverb—its meaning is dependent on the context of utterance.

- (2) a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **Yesterday**, my wife hired her and gave her a check for one month in advance.

In (3) below, we see narrative progression as in (1). One difference between these discourses is that (1)b makes no claim about how much temporal distance there is between the house cleaning and the hiring, though the distance is understood to be relatively short.³ In (3)b, however, we understand that the hiring is located a day after the house cleaning. This information is contributed by the anaphoric adverb *the day* after; its meaning is dependent on discourse context.

- (3) a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **The day after**, my wife hired her and gave her a check for one month in advance.

In (4) below, the times of the described events correlate with the order of appearance as in (1)-(3). However, the temporal location for the hiring event does not depend on the discourse context or the context of utterance. Such is the case because *on June 13, 1985* is a proper name, referring to the only June 13, 1985 in the history of the world. Adverbs of this sort are not deictic or anaphoric.

quantificational. I choose the classifications that I do because it is convenient to relate the adverbial distinctions to two binary features [+/- deictic] and [+/- anaphoric]. These features are not meaning components, but descriptive abbreviations. I acknowledge that other features may be relevant to account for the meaning of temporal locating adverbs.

³ As noted by Dowty (1986: 47) the temporal distance is “determined by the hearer’s understanding of the nature of events being described in a narrative, the overall degree of detail in which events are being described, and common knowledge about the usual temporal relationships among events...each successive sentence presents the very next event that transpires that is important enough to merit the speaker’s describing it to the hearer, given the purpose of the narration.”

- (4) a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **On June 13, 1985**, my wife hired her and gave her a check for one month in advance.

Finally, in (5) below, there are two possible interpretations: (i) the hiring event took place on the closest Sunday *after* the house cleaning or (ii) the hiring event took place on the closest Sunday *prior* to the speech time. The former interpretation demonstrates the anaphoric usage of *on Sunday* that is on a par with *the day after* in (3), while the latter interpretation demonstrates the deictic usage of *on Sunday* that is on a par with *yesterday* in (2).

- (5) a. 3 weeks ago on a Friday, Sue gave Fido a bath and cleaned our house.
 b. **On Sunday**, my wife hired her and gave her a check for one month in advance.

The goal of this paper is to provide an analysis of how the adverbs in the b-sentences above specify the temporal location of a given eventuality. Deixis and anaphoricity is insightful but not defining criteria since nominal expressions can also be classified in this way, viz. Fig. 2 below.

	CAN BE ANAPHORIC	CAN BE DEICTIC
<i>May 12, 1984</i>	No	No
<i>Yesterday</i>	No	Yes
<i>the day after</i>	Yes	No
<i>on Sunday</i>	Yes	Yes

Fig. 1 Typology of temporal locating adverbs (to be revised)

	CAN BE ANAPHORIC	CAN BE DEICTIC
<i>Frédéric Chopin</i>	No	No
<i>I</i>	No	Yes
<i>the composer</i>	Yes	No
<i>he</i>	Yes	Yes

Fig. 2 Typology of nominal expressions

Deixis and anaphoricity are also not the kind of notions that distinguish temporal locating adverbs that are *discourse transparent* and those that are not. As first noticed by Altshuler (2010, 2011), adding *that same day* to (1)b does not alter the narrative progression—the adverb is, as it were, ‘transparent to the progress’. This is illustrated below, in (6): specifying that the hiring took place on the same day as the house cleaning does not block the additional inference that the hiring took place after the house cleaning. Crucially, (6) is like (1) and unlike (3) in making no claim about how much temporal distance there is between the house cleaning and the hiring, though the distance is understood to be relatively short (see fn. 3).

- (6) a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **That same day**, my wife hired her and gave her a check for one month in advance.

The discourse transparency that we see in (6) can be replicated with related temporal locating adverbs and in non-narrative discourse contexts. Consider (7)b below, which differs from (6)b in containing the pluperfect (rather than the simple past). As a result, we understand that the hiring took place *prior* to the house cleaning. Crucially, this inference is present regardless of whether *that same month* and *that very month* are used. That is, these adverbs are transparent to the narrative regression.

- (7) a. Some month in May, Sue gave Fido a bath and cleaned our house.
 b. (**That same month/That very month**) my wife had hired her and had given her a check for one month in advance.

In (8) below there is no order that the events in (8)b,c are understood to have occurred in (though they are understood to precede the event described in (8)a). Such is the case whether or not *that same week* or *that very week* are present in (8)c. That is, specifying that the events described in (8)b,c all took place during the same week does not provide any new information that is not already inferred without *that same week* or *that very week*.

- (8) a. Bill will move next week.
 b. Last week, his house burned down.
 c. (**That same week/That very week**) he divorced Sue and he was fired.

In sum, what distinguishes *that same day* and related adverbs from those in (2)-(5) is that the time described by the former always preserve the temporal structure of a discourse, i.e. they are *transparent* to the independent rules that account for the temporal structure of a given discourse. Compare (8)c to (9)c below. No matter whether the adverb in (9)c is used deictically and/or anaphorically, the temporal structure that would be inferred without the adverb is *not* preserved, i.e. the adverbs in (2)-(5) are *non-transparent*; in (9)c they require the divorce and the firing to be understood as either following or preceding the house burning.

- (9) a. Bill will move next week.
 b. Last week, his house burned down.
 c. **{Yesterday/Today/The week before/On February 15th, 1981/On Sunday}** he divorced Sue and he was fired.

While there has been plenty of work on the semantics of particular temporal locating adverbs⁴, to the best of my knowledge, transparent adverbs like *that same day* have not been discussed—at least not in the

⁴ For example, see Lee & Choi 2009, Altshuler 2009, Hunter 2010; 2012, Ritz et al. 2012 on the meaning of *now*, following Kamp's (1971) classic work. There is also a vast body of research on prepositional phrases like *for 2 hours* and *in an hour*, which are different from the adverbs discussed here since they do not specify the temporal location of a given eventuality, but rather the duration. See Schaden forthcoming for a distinction between *measuring* and *localising* temporal expressions and see Morzycki 2001 for discussion about division of labor between inherent content of adverbs like "two hours" and content contributed by functional heads (e.g. "for") or syntactic constructions.

context of thinking about the defining, semantic properties of temporal locating adverbs.⁵ As noted by Kamp (1999/2013), work on the semantics of temporal locating adverbs goes back to (at least) Reichenbach (1947), who proposed that they should be treated as predicates of the *reference time* needed in the interpretation of the tensed clause that they occur in. By “reference time”, Reichenbach meant the temporal coordinate relative to which a described event is located. This coordinate can be the speech time (e.g. in present tense clauses) or some salient time that is contextually provided (e.g. in past tense clauses). In some instances the *reference time* is the *event time* (i.e. in cases whether the perfect is not used) but it need not be (i.e. in cases where the perfect is used).

Reichenbach’s insight was fundamental in the development of Discourse Representation Theory (DRT) in the 1980s, and the analysis of narrative progression in particular. According to one influential approach, developed by Hinrichs (1981, 1986) and Partee (1984), the semantic function of a temporal locating adverb is to introduce a new time discourse referent (DREF), which not only serves as the reference time of the clause in which the adverb occurs in, but also as an antecedent for an eventuality described in the subsequent clause (and possibly later in the discourse).

Several other researchers have proposed that temporal locating adverbs contribute a *time* (see, e.g. Rathert 2012 and references therein), but there is no consensus as to whether this time serves as the reference time. For example, Kamp and colleagues (e.g. Kamp & Reyle 1993, Kamp 1999/2013, Kamp et al. 2011) propose that the time contributed by a temporal locating adverb—which they call *location time*—is distinct from the reference time; it essentially has the function of Reichenbach’s *event time*.⁶ The reference time, according to Kamp and colleagues, is supplied by the tense and its value is fixed by the context.

von Stechow (2002) also claims that it is the tense which supplies the reference time. However, unlike the other researchers mentioned thus far, von Stechow assumes, following prior research, that temporal locating adverbs denote a set of times, which is intersected with the set of times denoted by a verb phrase or a tensed phrase (Bäuerle 1979, Dowty 1979, Stump 1985, Nerbonne 1986). The reference time supplied by the tense is in the set of the resulting intersection.

Although there are various proposals about the semantic contribution of temporal locating adverbs, to the best of my knowledge, there have not been explicit arguments put forth for which type of a proposal ought to be adopted. The different options can be reduced to whether one, both, or neither of the hypotheses below is adopted:

- (10) a. Temporal locating adverbs introduce a new time DREF.
 b. Temporal locating adverbs provide the reference time of the clause in which they occur in.

⁵ Work on the semantic properties of temporal locating adverbs has been sparse and far in between. For example, see Smith (1978), Dowty (1979), Bäuerle (1979), Nerbonne (1986), Kamp & Reyle (1993: Chapter 5), Ogihara (1996: §2.4), Vegnaduzzo (2001), Kamp & Schiehlen (2002), Altshuler (2010; 2011), Rathert (2012), Schaden forthcoming.

⁶ Kamp and colleagues define the *location time* as ‘the time when the event is said to occur and . . . the time at which the state is said to hold’ (Kamp & Reyle 1993).

In the next section, I briefly outline Partee’s (1984) analysis, which adopts (10)a and (10)b. The analysis is elegant and has been extremely influential over the years. However, based on the discourse transparency of *that same day* and related adverbs observed above, I argue that we cannot maintain both (10)a and (10)b. Moreover, I show that *that same day* poses non-trivial issues for other approaches to temporal locating adverbs—even those that deny (10)a and/or (10)b. Subsequently, I suggest a possible way in which we can make the correct predictions. In particular, I suggest we maintain Reichenbach’s original insight in (10)b and modify (10)a as follows: some, but not all temporal locating adverbs introduce a new time DREF; some merely constrain the temporal location of a described event relative to a salient time (or times) previously introduced into the discourse context. In this way, temporal adverbials are even more parallel to nominal expressions than what is provided in Fig. 1-2 above since, e.g. most anaphoric uses of pronouns and definite descriptions do not involve an introduction of a new individual into the discourse context.⁷

In section 3, I make this idea explicit within Compositional Discourse Representation Theory (CDRT, Muskens 1995; 1996), showing how temporal locating adverbs conspire with tense and aspect to constrain the temporal location of a described eventuality. This semantic theory is supplemented with a pragmatic model of temporal anaphora resolution, which fixes the temporal location of a described eventuality within a discourse. In particular, I adopt the idea that anaphora resolution reduces to satisfaction of constraints imposed by coherence relations: it can look at many anaphors at once and can appeal to world knowledge, especially when there is a lot of content available (Hobbs 1978, 1979, 1990).

In section 4, I look at the adverb *currently*. I argue that it is like *that same day* in constraining the temporal location of a described eventuality relative to a salient time previously introduced into the discourse context without introducing one of its own. In passing, I also discuss the related adverb *now* and end the section by discussing a challenge that *currently* presents for the interface between adverbial and aspectual meaning.

2 Temporal locating adverbs and reference time introduction

2.1 Partee’s (1984) theory

The previous section started by looking at the discourse in (11) below, which was said to exemplify narrative progression.

- (11)a. ...Sue gave Fido a bath and cleaned our house.
 b. My wife hired her and gave her a check for one month in advance...

Narrative progression arguably motivates the aforementioned notion of a

⁷ As noted by an anonymous reviewer ‘anti-reflexives’ in Dogrib suggest that some pronouns may introduce a new individual DREF. They obey all the anaphoric constraints, but they mean (roughly): “different referent from antecedent” (Saxon 1984).

*reference time*⁸, which in the context of a narrative, is the time to where a story has thus far developed. This notion builds on Karttunen’s (1976) idea that grammatical elements can introduce abstract objects, namely DREFs, whose ‘lifespan’ determines how long they can serve as antecedents for anaphoric expressions later in the discourse.⁹ A DREF can be thought of as a variable under an assignment function that stands for an entity introduced in the discourse (Kamp 1981, Kamp & Reyle 1993) or as a function that takes an information state as an argument and returns an object in that state (Muskens 1995, 1996; see next section).

Building on work by Kamp (1979; 1981) and Hinrichs (1981), Partee (1984) proposed that in narrative discourse, eventive clauses introduce a new time DREF, which serves as the reference time for the interpretation of that clause and whose lifespan depends on whether there are subsequent eventive sentences, temporal adverbs, *when*-clauses and any other temporal expressions that introduce a new time DREF.¹⁰ For example, reconsider (11) above, which contains four eventive clauses (without adverbs). According to Partee’s theory, the sentence *Sue gave Fido a bath* introduces a new time DREF, namely a time ‘just after’ the bath-giving event.¹¹ This DREF serves as the reference time for the subsequent clause that describes a house-cleaning event since there are no intervening expressions that would cut off its lifespan.

Since *cleaned our house* in (11)a is an eventive sentence, it too introduces a new time DREF, namely a time ‘just after’ the house-cleaning. It is this DREF and not the one introduced by *Sue gave Fido a bath* that serves as the reference time for the subsequent clause in (11)b. Put differently, the life span of the DREF introduced by the initial clause in (11)a ‘runs out’ once the subsequent eventive clause is processed.¹² Proceeding in this way, we derive the narrative progression in (11)a,b.

One way in which Partee’s analysis is elegant is that it is almost trivial to incorporate the semantic contribution of temporal locating adverbs. Consider the following hypothesis, which builds on Hinrichs (1981/86):

⁸ Some have argued that narrative progression depends solely on pragmatic inference and reference times are superfluous (e.g. Lascarides & Asher 1993 and Kehler 2002). However, contrast like (i)-(ii) below show that narrative progression is not “just a matter of pragmatic inference” (Moens & Steedman 1988: 22). See also Kamp & Reyle (1993: 522), and Altshuler (2012) for more discussion.

- (i) At five o'clock, Harry walked in, sat down and took off his boots.
- (ii) #At five o'clock, Harry took off his boots, sat down and walked in.

⁹ The idea that DREFs have life spans was originally motivated by contrasts like (i)-(ii):

- (i) Jones^x owns a Porsche^y. He_x likes it_y.
- (ii) #Jones_x doesn't [own a^y Porsche]. He_x likes it_y (however).

In (i), the DREFs (superscripted *x*, *y*) are picked up by anaphoric pronouns (subscripted *x*, *y*). In (ii), however, the lifespan of the DREF introduced by the indefinite, *a^y*, under negation is limited to the scope of the negation operator —i.e. *it_y* comes ‘too late’.

¹⁰ Here, I focus solely on eventive sentences and temporal locating adverbs to demonstrate Partee’s theory. However, note that a crucial feature of Partee’s theory is that stative clauses do not introduce a new time DREF.

¹¹ The ‘time just after’ is intentionally vague. See footnote 3 for more discussion.

¹² In a discourse like “Sue came home. She was tired. She sat down” the life-span of the reference time introduced by the initial sentence lasts until the third sentence since the second sentence is stative and does not introduce a new time DREF.

- (12) HYPOTHESIS: The semantic function of temporal locating adverbs is to introduce a new time DREF, which serves as the reference time for the clause in which the adverb occurs.

To see the fruits of (12) within Partee’s analysis, consider the following discourse:

- (13)a. On May 12, 1984, Sue cleaned our house.
 b. The day before, my wife hired her...

The analysis of (13) begins with the adverb *May, 12, 1984* which introduces a new time DREF: May 12, 1984. This DREF serves as the reference time for the bath-giving event. As before, the eventive clause *Sue gave cleaned our house* introduces a new time DREF, namely the time ‘just after’ the house cleaning. The crucial computation comes in (13)b, where we consider the contribution of *the day before*. Without this adverb, the hiring event described in (13)b would be located at a time ‘just after’ the house cleaning because there is nothing to “cut off” the life span of the DREF introduced by *cleaned our house* in (13)a. With the adverb *the day before*, however, the life span of this DREF is “cuts off” because, given (12), the adverb introduces a new time DREF, which serves as the reference time. It is this new reference time, i.e. May 11, 1984, which serves as the temporal location for the hiring event described in (13)b, and crucially not the time ‘just after’ the house cleaning.

Partee’s analysis naturally extends to the other temporal locating adverbs considered at the outset of the paper: the adverbs in (14)b-(16)b below all introduce a new time DREF, which serves as the reference time, i.e. the temporal location for the hiring event. While the nature of the introduced time differs in each case (e.g. whether it anchored to speech time, a salient discourse time, or neither), it must be this time rather than the DREF introduced by the previous clause that serves as the temporal location for the hiring event.

- (14)a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **Yesterday**, my wife hired her and gave her a check for one month in advance.
- (15)a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. **June 20, 1984**, my wife hired her and gave her a check for one month in advance.
- (16)a. 3 weeks ago on a Friday, Sue gave Frido a bath and cleaned our house
 b. **On Sunday**, my wife hired her and gave her a check for one month in advance.

2.2 Puzzle from “that same day” and related adverbs

In this section, I would like to argue that Partee’s (1984) analysis of temporal anaphora outlined in the previous section fails to account for

discourse transparency of *that same day* discussed at the outset. Recall that specifying that the hiring took place on the same day as the house cleaning does not block the additional inference that the hiring took place after the house cleaning:

- (17) a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. (**That same day**) my wife hired her and gave her a check for one month in advance.

The observed temporal ordering in (17) is surprising given Partee's analysis discussed in the previous section. According to this analysis, the hiring event described in (17)b takes place during the time DREF introduced by *that same day*. If we make the seemingly harmless assumption that this adverb denotes a salient day previously mentioned in the discourse, then we would say that *that same day* picks out May 12, 1984. While this correctly predicts that the hiring event described in (17)b took place on this day, nothing is said about how this event is ordered with respect to the cleaning event described in (17)a, which also takes place on May 12, 1984. Put differently, because the life span of the time DREF in (17)a is "cut off" by *that same day* in (17)b, the 'time just after' the house cleaning cannot serve as the reference time and we can't account for the understood narrative progression.

A helpful way of restating the problem is to say that we cannot maintain the hypotheses in (18) below, which together form the aforementioned hypothesis in (12), discussed in the previous section.

- (18) TWO HYPOTHESES
 a. Temporal locating adverbs introduce a new time DREF.
 b. Temporal locating adverbs provide the reference time of the clause in which they occur in.

For the sake of argument, let us assume that (18)a is true, but (18)b is false. That is, temporal locating adverbs introduce a new time DREF (i.e. the time they denote), but this time does not serve as the reference time of the clause that they occur in. Rather, it is the tense that provides the reference time. Such an analysis is advocated by, e.g. Kamp and colleagues (Kamp & Reyle 1993, Kamp 1999/2013, Kamp et al. 2011) and it could account for the seemingly problematic (17) above. The analysis goes something like this. In (17)b, *that same day* introduces a new time DREF which stands for May 12, 1982. Moreover, the past tense picks out the time 'just after' the house cleaning, which serves as the reference time for the clause. Assuming that the described event is located with respect to both the newly introduced DREF and the reference time, we can account for the inference that the hiring took place on May 12, 1982 and that it took place after the house cleaning.

One question for this analysis, however, concerns how the described event comes to be related to the two times described above—i.e. what Kamp and colleagues would call the *location time* and the *reference time*. Since, on Kamp et al.'s analysis, the relation between a described eventuality and the two times depends on the aspectual profile of the

described eventuality, i.e. whether it is stative or eventive, it seems natural to assume that it is the aspect that specifies the relevant relations (see Kamp & Reyle 1993: Chpt. 5 for more discussion). This is problematic, however, if one believes that the semantic function of aspect is to relate an event to a single temporal coordinate, as in Klein 1994 and subsequent work (see e.g. Kratzer 1998, Paslawska & von Stechow 2003, Bary 2009).

One could, of course, conclude based on the data in (17) that multiple coordinates are necessary.¹³ Another possibility would be to give up (18)a in addition to (18)b and say that temporal locating adverbs denote a properties of times that are intersected with the properties of times denoted by the VP (Bäuerle 1979, Dowty 1979, Stump 1985, Nerbonne 1986); the tense supplies the reference time that is in the set resulting from the intersection. This position is adopted by von Stechow (2002), who follows Partee (1973), Heim (1994), Kratzer (1998), Kusumoto (1999) and others in treating tenses as free variables whose value is determined by an assignment delivered by the context:

- (19) Semantic Tenses are symbols of type i which bear time variables as indices. Let c be the context of the utterance with t_c the speech time.
- a. $\llbracket \text{PRES} \rrbracket^{m,g}$ is the speech time t_c .
 - b. $\llbracket \text{PAST}_j \rrbracket^{m,g}$ is defined only if $g(j)$ precedes the speech time t_c . If defined, $\llbracket \text{PAST}_j \rrbracket^{m,g} = g(j)$.
 - c. $\llbracket \text{FUTR}_j \rrbracket^{m,g}$ is defined only if $g(j)$ follows the speech time t_c . If defined, $\llbracket \text{FUT}_j \rrbracket^{m,g} = g(j)$.

Although von Stechow does not consider the effects that adverbs have on discourse structure, his analysis could, surprisingly, account for the problematic (17) above as follows: the denotation of *May 12, 1984* is intersected with the meaning of *my wife hire*; the context delivers the value for the free variable encoded by PST as being the ‘time just after’ the house cleaning, which is in the set of times that results from the intersection. This makes the correct prediction that the hiring event took place on May 12, 1982 and that it took place after the house cleaning.

Despite being able to account for (17), von Stechow’s analysis faces a non-trivial question when we reconsider the aforementioned discourse in (20) below:

- (20)a. On May 12, 1984, Sue cleaned our house.
 b. The day before, my wife hired her...

In particular, we can ask about the function of the tense in (20)b. Assuming the past tense on “hire” is treated like a pronoun, viz. (19)b, what value is provided by the context assignment function? Clearly the relevant time is May 11, 1984, but this time is not previously established in the discourse context. Moreover, the time ‘just after’ the hiring event

¹³ This is the position taken by Altshuler 2012, albeit for independent reasons. See also Nelken & Francez 1997 and Kamp et al 2013. Unfortunately, Kamp and colleagues do not provide explicit arguments for the necessity of both a location and a reference time.

described in (20)a—which is presumably a possible antecedent—would clash with the meaning of *the day before* (i.e. it could not be in the set resulting from intersecting the meaning of *the day before* and *my wife hire her*). One could claim that (20)b involves accommodating a presupposition of a unique time, but this seems far-fetched.

A possible response to this challenge is to adopt the view that—rather than being pronoun-like—tenses denote existential quantifiers with a domain restriction variable over reference times. This is the view advocated by, e.g. Roberts (1995), von Stechow (2009), Altshuler & Schwarzschild (2013), and it would allow us to say the following about (20)b: the restriction on the reference time provided by *the day before*, namely the property of being May 11, 1984 renders prior context irrelevant. In this way we would capture Partee’s insight that temporal locating adverbs “cut off” the life span of the previously introduced DREF; the difference being that the adverbs render a previously introduced DREF irrelevant because they provide “enough” restriction on the domain of quantification.

Unfortunately, like Partee’s analysis, this view also faces a non-trivial question with respect to *that same day*: Why should the restriction provided by *the day before* be sufficient in (20)b, but the restriction provided by *that same day* be insufficient in (17)b, where prior context is essential? This question suggests a particular avenue one would have to take in thinking about the distinction between transparent and non-transparent temporal locating adverbials. In particular, it invites an investigation about domain restriction encoded by the tense and how this restriction interacts with the restriction enforced by particular temporal locating adverbials. This avenue differs from what is necessitated by the other theories mentioned above. For example, Kamp & Reyle’s theory necessitates an investigation into the interaction between adverbial and aspectual meaning. In particular, whether aspectual expressions do, in fact, encode multiple temporal coordinates. In contrast, a pronoun theory of tense (as assumed by, e.g. von Stechow 2002) necessitates an investigation into anaphora resolution. In particular, how we can make sense of the fact that temporal locating adverbs often signal to the tense that prior discourse context is irrelevant.¹⁴ Finally, Partee’s theory necessitates an investigation into the update properties of temporal locating adverbs. It is this investigation that I pursue in the remainder of the paper.

In what follows, I will show how we can account for the data discussed in this section, while maintaining Reichenbach’s original insight that temporal locating adverbs provide the reference time of the clause in which they occur in. To do so, I propose the following revision to Partee’s analysis. It concerns (18)a above: some, but not all temporal locating adverbs introduce a new time DREF; those adverbs which are transparent, e.g. *that same day*, merely constrain the temporal location of a described

¹⁴ One possibility is to say that temporal locating adverbs bind the time variable encoded by the tense. However, in doing so, we would have to give up the key idea of von Stechow’s (2002) analysis, namely that such adverbs denote a property of times that are intersected with VP meanings. Thanks to Corien Bary for discussing this possibility.

event relative to a salient time (or times) previously introduced into the discourse context.

In the next section, I make this idea explicit within CDRT, showing how temporal locating adverbs conspire with tense and aspect to constrain the temporal location of a described eventuality. This semantic theory is supplemented with a pragmatic model of temporal anaphora resolution, which fixes the temporal location of a described eventuality within a discourse. In particular, I adopt the idea that anaphora resolution reduces to satisfaction of constraints imposed by so-called *coherence relations*, which characterize the possible ways in which successive utterances could be connected to form a coherent discourse (Hobbs 1978, 1979, 1990). Coherence relations have truth conditional effects and are thus a part of the linguistic content of the discourse; they are computed on the basis of commonsense/non-monotonic reasoning “with a variety of information sources: compositional and lexical semantics, the content of the discourse context, domain knowledge, and the cognitive states of the dialogue that the agents play in” (Asher & Lascarides 2003: 37).¹⁵ The coherence relation that would adequately characterize (17)—with or without *that same day*—is OCCASION (see (21) below) since we understand that Sue’s hiring was “occasioned” or was “brought about” by her cleaning the house and washing the dog. Put differently, Sue’s hiring is understood to be contingent on her doing a good job with the described chores.

- (21) OCCASION(φ , ψ): Infer that an eventuality e described by a discourse segment ψ is contingent on the eventuality e' described by the preceding discourse segment φ .¹⁶

The question that we will need to answer is: what information sources are responsible for OCCASION being salient in (17)? As previewed above, I will propose that the semantics of aspect and temporal adverbs is vital to the interpretation of (17). In particular, I will propose that (17)a has a perfective operator, PFV, in its logical form which introduces a salient time ‘just after’ the described event and thereby moves the narrative forward. By choosing this time as an antecedent in (17)b, *that same day* preserves the narrative structure of the discourse and justifies linking (17)a and (17)b via OCCASION.

It is important to note that the linking of (17)a and (17)b via OCCASION is driven by compositional and lexical semantics because the other sources noted above are unlikely. If the content of the discourse context, domain knowledge, and the cognitive states of the dialogue that the agents play in tell us anything about when people work in relation to when they are hired it’s that people typically begin work *after* being hired. That is, if we solely consider information other than the compositional and

¹⁵ See also Mann & Thompson 1988, Knott 1996; Knott & Mellish 1996, Kehler 2002, Webber *et al.* 2003, among many others.

¹⁶ The contingency relationship could be defined in terms of an event’s “change of state” or its consequent state relative to the other event, e.g. e_ψ is understood to be contingent on e_φ iff e_ψ is contained within the consequent state of e_φ (Moens & Steedman 1988, Webber 1988, Hobbs 1990). As a result of the contingency relationship, e_ψ and e_φ are ordered by the complete precedence relation: $e_\varphi <_t e_\psi$

lexical semantics, then it should be possible (if not probable) to infer the mirror image of OCCASION, namely EXPLANATION, defined below:

- (22) EXPLANATION(φ , ψ): Infer that an eventuality e described by a discourse segment φ is contingent on the eventuality e' described by a succeeding discourse segment ψ .

However, this is not possible. In order to infer EXPLANATION, the past perfect would have to be used:

- (23)a. On May 12, 1984, Sue gave Fido a bath and cleaned our house.
 b. That same day, my wife had hired her and had given her a check for one month in advance.

The fact that (17) doesn't have the reading that is available in (23) is unexplained by Partee's theory, which merely requires the hiring to take place on May 12, 1984. This fact is also unexplained by any analysis that does not consider aspectual and adverbial meaning as the key reason for the narrative progression and the discourse transparency in (17).¹⁷

3 CDRT analysis of temporal locating adverbs

3.1 Framework

This section briefly outlines Muskens' (1995; 1996) Compositional Discourse Representation Theory (CDRT), which underlies the analysis proposed in this paper. This framework is chosen over DRT, which underlies Partee's (1984) analysis, in order to provide dynamic meanings of sub-sentential expressions as terms in a typed λ -calculus. While other compositional presentations of DRT exist, I find Muskens' presentation especially straightforward.¹⁸

CDRT treats the syntax of DRT—i.e. the language of *Discourse Representation Structures* (DRSs)—as an abbreviation for more elaborate terms. Muskens starts from the assumption that DRSs constitute a binary relation between input and output assignments (embeddings in DRT terms). This relation is responsible for the dynamic nature of DRT. Assignments are functions from the set of DREFs to the domain. A DRS K is a pair of a set of DREFs δ, \dots, δ' (i.e. the universe of K) and a set of conditions C, \dots, C' . As illustrated below, in (24), the meaning of a DRS K

¹⁷ Asher and Lascarides (1993) posit axioms that entail that OCCASION (NARRATION in their theory) is inferred by default. While this would account for why there is narrative progression in (17), treating OCCASION as the default does not explain the infelicity of (i) below (see Kamp & Reyle 1993 and Altshuler 2012 for other examples). For similar reasons, Asher and Lascarides (2003) revise the idea that OCCASION is the default, proposing that there are various reasons why OCCASION is inferred. However, these reasons don't explain why OCCASION rather than EXPLANATION is salient in (17).

(i) #At five o'clock, Harry took off his boots, sat down and walked in.

¹⁸ Cf. Zeevat 1989, Latecki and Pinkal 1990, Groenendijk & Stokhof 1990, 1991, Asher 1993, van Eijck & Kamp 1996, van Noor & Muskens 2003, Kamp, van Genabith & Reyle 2005. These proposals could be adapted along similar lines to what is presented here.

is the set of pairs of assignments $\langle f, g \rangle$ such that g differs from f at most with respect to the values that they assign to the DREFs in the universe of K , written $f[\delta, \dots, \delta']g$, and g makes the conditions of K true (cf. Groenendijk and Stokhof 1991).

$$(24) \text{ a. } \llbracket [\delta, \dots, \delta' \mid C, \dots, C'] \rrbracket^{20} = \\ \text{ b. } \{ \langle f, g \rangle \mid f[\delta, \dots, \delta']g \ \& \ g \in \llbracket C \rrbracket^{20} \cap \dots \cap \llbracket C' \rrbracket^{20} \}$$

CDRT mimics the dynamic nature of DRT in type logic by adopting assignments in the object language. In particular, the set of primitive types—i.e. one that includes individuals (type e), intervals of time (type i), eventualities (type v), possible worlds (type ω) and truth-values (type t)—is enriched with type s for *environments*,¹⁹ which behave like assignments; they “...are very much like the program states that theoretical computer scientists talk about, which are lists of the current values of all variables in a given program at some stage of its execution” (Muskens 1996: 11). In this paper, I assume the set of primitive types below, which is analogous to what is provided in Muskens 1995, with the exception that I disregard possible worlds in the ontology. This is done for the sake of simplicity.

DEFINITION 1 (Types)

- $e, i, v, t, s \in \text{Typ}$
- $(\mu\alpha) \in \text{Typ}$, if $\mu, \alpha \in \text{Typ}$

To see how environments are made part of the object language, consider (25) below. The DRS in (25)a serves as an abbreviation for the type $s(\text{st})$ expression in (25)b, where i and j are variables over environments. Unlike in DRT, DREFs in CDRT are functions that take an environment as an argument and return an object in that environment. Assuming that this object can be of any type, DREFs are type $s\alpha$, where $\alpha \in \text{Typ}$.²⁰ Moreover, conditions are treated as predicates of environments, i.e. expressions of type st .

$$(25) \text{ a. } [\delta_{s\alpha}, \dots, \delta'_{s\alpha} \mid C_{st}, \dots, C'_{st}] \quad := \\ \text{ b. } \lambda i \lambda j. i[\delta, \dots, \delta']j \wedge Cj \wedge \dots \wedge C'j$$

Unlike (24)a, (25)a no longer gets a direct interpretation. Rather, the form that it abbreviates, namely (25)b, gets assigned an interpretation. The meaning of a sentence ϕ is a relation that holds between environments i and j just in case j is an environment that might result from the interpretation of ϕ in environment i .

Below, I provide examples of expressions of various types that are found in the analysis that follows.

¹⁹ I follow Stone (1997) in using *environment* instead of Muskens’ loaded term *state*.

²⁰ In this way DREFs are similar to Montague’s individual concepts: they do not refer directly, but only as a function of the current discourse context (Brasoveanu 2007).

DEFINITION 2 (Constants and variables)

For any type $\alpha \in \text{Typ}$, there is a denumerable set of α -constants Con_α and a denumerably infinite set of α -variables Var_α , including the following sets:

- $\text{Con}_e = \{\text{sue, fido, ...}\}$
- $\text{Con}_i = \{\text{may.12.1984, ...}\}$
- $\text{Con}_{\text{et}} = \{\text{man, ..., house, ...}\}$
- $\text{Con}_{\text{it}} = \{\text{day, ..., week, ...}\}$
- $\text{Con}_{(e(\text{vt}))} = \{\text{enter, ..., clean.our.house, ...}\}$
- $\text{Con}_{(e(e(\text{vt})))} = \{\text{hire, ..., read, ...}\}$
- $\text{Con}_{\text{se}} = \{u_1, u_2, ..., u', u'', ...\}$
- $\text{Con}_{\text{si}} = \{t_1, t_2, ..., t', t'', ...\}$
- $\text{Con}_{\text{sv}} = \{e_1, e_2, ..., e', e'', ...\}$
- $\text{Var}_{(si(s(st)))} = \{Q, Q', ...\}$
- $\text{Var}_{(sv(s(st)))} = \{P, P', ...\}$
- $\text{Var}_s = \{i, i', ..., j, j', ..., k, k'\}$
- $\text{Var}_{\text{se}} = \{x, x', ...\}$
- $\text{Var}_{\text{si}} = \{t, t', ...\}$
- $\text{Var}_{\text{sv}} = \{e, e', ...\}$

Let us now consider abbreviations that are relevant to the analysis proposed in this paper. Def. 3 expresses that i differs from j at most with respect to the values that they assign to δ (Muskens 1995: 6). Note that ST is a predicate that is true of drefs, i.e. it stands for the predicate “is a dref of type ($s\alpha$).” This predicate is used by Muskens to ensure that drefs and environments behave as variables and assignments respectively (see AX1-AX3 in Muskens 1995: 6-7).

DEFINITION 3

If δ is a term of type $s\alpha$, where $\alpha \in \text{Typ}$, then $i[\delta]j$ abbreviates the conjunction of:

- (i) $\forall \delta'_{s\alpha} [[\text{ST}_{(s\alpha)t}(\delta') \wedge \delta' \neq \delta] \rightarrow \delta'(j) = \delta'(i)]$ and
- (ii) the conjunction of $\forall \delta'_{s\beta} [\text{ST}_{(s\beta)t}(\delta') \rightarrow \delta'(j) = \delta'(i)]$,
for all $\beta \in \text{Typ} - \{\alpha\}$

Def. 4 provides abbreviations for DRS conditions which are used in the proposed meanings. I refer the reader to Muskens (1995: 8) for the semantics of the abbreviated expressions.

DEFINITION 4 (DRT abbreviations)

- i. $\mathfrak{R}\{\delta_{s\alpha}, \dots, \delta'_{s\alpha}\} := \lambda i. R(\delta_i, \dots, \delta'_i)$ e.g. $\text{man}\{u_1\} := \lambda i. \text{man}(u_1 i)$
 $\delta_{s\alpha} = \delta'_{s\alpha} := \lambda i. \delta i = \delta' i$ e.g. $t_1 = t_2 := \lambda i. t_1 i = t_2 i$
 $\alpha_a^\circ := \lambda i. a$ e.g. $\text{sue}^\circ := \lambda i. \text{sue}$
- ii. $C_{st}, C'_{st} := \lambda i. C_i \wedge C'_i$ (conjoined condition)
- iii. $K_{sst} ; K'_{sst} := \lambda i \lambda j. \exists k [K i k \wedge K' k j]$ (sequencing)
- iv. $[| C_{st}, \dots, C'_{st}] := \lambda i \lambda j. i = j \wedge C_j \wedge \dots \wedge C'_j$ (test box)
- v. $[\delta_{s\alpha}, \dots, \delta'_{s\alpha} | C_{st}, \dots, C'_{st}] := \lambda i \lambda j. i[\delta, \dots, \delta'] j \wedge C_j \wedge \dots \wedge C'_j$ (update & test)
- vi. $K_{sst} \Rightarrow K'_{sst} := \lambda i. \forall j [K i j \rightarrow \exists k [K' j k]]$ (DRT implication)
- vii. $\neg K_{sst} := \lambda i. \neg \exists j [K i j]$ (DRT negation)

Of particular importance is the expression ‘ $K_{sst} ; K'_{sst}$ ’ in Def.4.iii above, which provides an abbreviation for *sequencing* of two DRSs K and K' . The idea is that “the concatenation of sentences in simple narrative discourse is nothing but the *sequencing* of instructions that we find in imperative programming languages, usually written as ‘;’” (Muskens 1996: 7). This

idea is formally implemented above by saying that a sequence $K ; K'$ can bring information from an input environment i to an output environment j if and only if K can bring it from i to some intermediary environment k and K' can bring it from k to j .

With the representational language in place, let us now consider in more detail the assumed temporal ontology. As mentioned above, I assume an ontology consisting of time intervals and eventualities, of types type i and v respectively. Accordingly, the basic domains D_i and D_v are sets of time intervals and eventualities respectively. Following Muskens 1995, I assume that D_i is ordered by the *complete precedence* relation $<$, which is a constant of type $(i(it))$; it can be used to define other relations such as \leq and \sqsubseteq (van Benthem 1983). Moreover, I assume that the domains of eventualities are domains of singular eventualities. If plurality is added to the theory, a Boolean structure needs to be imposed on top of the structures introduced here (Hinrichs 1985, Krifka 1989).

Finally, I assume that D_v is ordered by the part-of relation \sqsubseteq , which is subject to the constraint in Def. 5 below. According to this definition, the domains of eventualities and time intervals are linked through a temporal trace function τ , which takes an eventuality and returns its run time (Link 1987). That is, τ is a constant of type vi .

DEFINITION 5

For all eventualities e and $e' \in D_v$: if $e \sqsubseteq e'$ then $\tau(e) \sqsubseteq \tau(e')$

In what follows, I will write the more concise formula $t < e$ to abbreviate $t < \tau(e)$. Similarly, I will write $e \sqsubseteq t$ for $\tau(e) \sqsubseteq t$.

3.2 Analysis of discourses with *that same day* and related adverbs

In this section, I would like to propose an analysis for the discourses in (26) and (27) below—which are simplified versions of the discourses we saw in section 2—using the framework outlined in the previous subsection. Recall, that (26) exemplifies narrative progression, while (27) exemplifies a temporal structure where there is no order that the events described in (27)b,c are understood to have occurred in.

- (26) a. On May 12, 1984 Sue cleaned our house.
 b. That same day, my wife hired her.
- (27) a. Bill will move next week.
 b. Last week, his house burned down.
 c. That same week he divorced Sue.

We begin with (26), which—as we have seen—proposes a problem for Partee’s (1984) analysis. I propose to treat this discourse as arising from the syntactic representation in (28):

- (28) a. $[_{TP}[_{AdvP} \text{ on May } 12^{\text{th}} \text{ } 1984^{\text{t}_1}][_{TP} \text{ PST } [_{AspP} \text{ PFV}^{\text{e}_2, \text{t}_2}[_{VP} \text{ Sue}^{\text{u}_3} \text{ clean our house}]]]]]$
 b. $[_{TP}[_{AdvP} \text{ that same day}^{\text{t}_1, \text{t}_2}][_{TP} \text{ PST } [_{AspP} \text{ PFV}^{\text{e}_4, \text{t}_4}[_{VP} \text{ my wife}^{\text{u}_5} \text{ hire her}^{\text{u}_3}]]]]]$

I follow Barwise 1987, Muskens 1995 and others in indexing antecedents with superscripts and anaphoric expressions with subscripts, further requiring that no two superscripts be the same. As noted by Beaver (1999), Bittner (2007), Muskens (2011) and others, assuming that inputs come with correct indices begs an important question, since anaphora resolution is subject to semantic constraints and explaining these constraints is a crucial part of one's theory. I am sympathetic to this view, especially since the major goal of this paper is to propose semantic constraints of temporal locating adverbs on anaphora resolution. Consequently, it is important to view the coindexation in (28) as a matter of convenience.²¹ In what follows, I will: (i) show how particular coindexation, along with the proposed semantics, allows us to make the correct predictions about the discourses above, then (ii) discuss why alternative coindexations are ruled out by the semantics, and then, finally, (iii) show how other alternative coindexations allowed by the semantics are ruled out on pragmatic grounds.

With regard to the assumed phrase structure in (28), note that I will not provide meanings of VP-internal expressions.²² Moreover, I will treat all temporal locating adverbs as syntactically on a par, i.e. as adverbial phrases, without providing the internal structure of such expressions. This is a gross idealization since an expression like *currently* surely has a different syntax from *on May 12th, 1984* and *the day after*. For the current purposes, however, all that matters is that these expressions are of the same semantic type. Finally, I make the standard assumption that English sentences in the 'simple past' have a covert aspectual operator in the head of AspP. Following Smith 1991, Kratzer 1998, Szabó 2004, Landman 2008 and others, I assume that many eventive sentences of this sort have a covert perfective operator (PFV).²³

Let us now proceed to derive the meaning of (28) using the framework introduced in the previous section. Working bottom up, (29) below provides the meaning of the VP in (28)a, which is an abbreviation for the expression in (30) of type (sv(sst))—i.e. it is a function of the following kind: it takes a function from an environment to an event that has the property of being a house cleaning in that environment and returns a relation that holds between two environments i and j if (i) they differ maximally in the dref u_3 and (ii) the value of u_3 in the second environment j is Sue, who cleans our house.

$$(29) [\text{VP Sue}^{u_3} \text{ clean our house}] \rightsquigarrow \lambda e.[u_3 \mid u_3 = \text{sue}^\circ, \text{clean.our.house}\{u_3, e\}]$$

$$(30) \lambda e \lambda i \lambda j. i[u_3]j \wedge u_3 j = \text{sue} \wedge \text{clean.our.house}(u_3 j, e j)$$

²¹ See Muskens 2011 for a procedure in which CDRT could interleave interpretation and coindexing in a way analogous to DRT, where coindexation is not assumed to be part of the syntax.

²² See Muskens 1996 and Brasoveanu 2007 for a CDRT analysis of nominal expressions.

²³ Since English is grossly underspecified in terms of aspectual distinctions (Bittner 2008), I refrain from assuming that *all* eventive sentences in the simple past have a covert perfective operator. In a discourse like *Max fell. John pushed him*, the latter sentence arguably has a covert perfect operator (cf. *Max fell. John had pushed him*).

The meaning of the VP combines with PFV, whose meaning is provided in (31); it is an abbreviation for the expression in (32). As is standard in work on aspect, PFV requires the introduced event e_2 to be contained within a time argument t ,²⁴ which (as we will see) is saturated by temporal locating adverbs and serves as the reference time for the described event.

$$(31) [\text{Asp PFV}^{e_2, t_2}] \rightsquigarrow \lambda P \lambda t. [e_2, t_2 \mid e_2 \subseteq t, e_2 < t_2] ; P(e_2)$$

$$(32) \lambda P \lambda t \lambda i \lambda j. \exists k (i[e_2, t_2] k \wedge e_2 k \subseteq t k \wedge e_2 k < t_2 k \wedge P(e_2) k j)$$

Another key property of PFV is that it introduces a time t_2 that follows the described event e_2 (recall Partee’s analysis). This is especially apparent when we consider (33) below, which combines (30) and (32).

$$(33) \lambda t \lambda i \lambda j. \exists k (i[e_2, t_2] k \wedge e_2 k \subseteq t k \wedge e_2 k < t_2 k \wedge k[u_3] j \wedge u_3 j = \text{sue} \\ \wedge \text{clean.our.house}(u_3 j, e_2 j))$$

According to (33), there is an environment k in which the value of t_2 is after an event in k . We know that this time is available for anaphoric pick-up because the output environment that is passed on for the interpretation of subsequent discourse is j , which differs from k only in the value that it assigns to u_3 (and crucially not in value assigned to t_2). Whether the time is actually picked up as an antecedent depends on independent rules of anaphora resolution, which I address later in this section.

Let us now move on to consider the meaning of the past tense. As illustrated in (34)-(35) below, I assume that there is a past tense operator, PST, which does not introduce a new DREF, but merely checks that the time argument precedes the speech time. Here, I use t_0 to describe a constant function (of type si) from environments to the speech time.

$$(34) [\text{T PST}] \rightsquigarrow \lambda Q \lambda t. [\mid t < t_0] ; Q(t)$$

$$(35) \lambda Q \lambda t \lambda i \lambda j. \exists k (i = k \wedge t k < t_0 k \wedge Q(t) k j)$$

As the final step to deriving the meaning of (28)a, consider the meaning of the adverbial phrase *on May 12th 1984* below:

$$(36) [\text{AdvP on May 12}^{\text{th}} 1984^{t_1}] \rightsquigarrow \lambda Q. [t_1 \mid t_1 = \text{may.12.1984}^\circ] ; Q(t_1)$$

$$(37) \lambda Q \lambda i \lambda j. \exists k (i[t_1] k \wedge t_1 k = \text{may.12.1984} \wedge Q(t_1) k j)$$

Here we see that *May 12th 1984* introduces a time that names May 12, 1984. In this way, it is semantically on a par with the proper name *Sue*, cf. (29)-(30) above. As we shall see shortly, *that same day* differs from *May 12th, 1984* in (i) not introducing a new time DREF and (ii) retrieving two salient DREFs previously introduced into the discourse context.

When we combine the meanings in (29), (31), (34) and (36), we get the meaning in (38) below, which is an abbreviation for the expression in (39)

²⁴ Note that PFV does not really introduce an event, but a function from an environment to an event in that environment (recall the discussion in section 3.1 of DREFs in CDRT). I will continue to say ‘event’ for simplicity of exposition; the same goes for ‘time’ and ‘individual’.

of type sst. Note that I will henceforth use the convention of putting conditions that contain antecedents for subsequent discourse, viz. $e_2 < t_2$, at the end of the formula.

- (38) $[_{TP} [_{AdvP} \text{ on May 12}^{\text{th}} \text{ 1984}^{\text{t}_1}] [_{TP} \text{ PST } [_{AspP} \text{ PFV}^{e_2, t_2} \text{ Sue}^{\text{t}_3} \text{ clean our house}]]] \rightsquigarrow$
 $[t_1, e_2, t_2, u_3 \mid t_1 = \text{may.12.1984}^\circ, t_1 < t_0, e_2 \subseteq t_1,$
 $u_3 = \text{sue}^\circ, \text{clean.our.house}\{u_3, e_2\}, e_2 < t_2]$
- (39) $\lambda i \lambda j. i[t_1, e_2, t_2, u_2] j \wedge t_{1j} = \text{may.12.1983} \wedge t_{1j} < t_{0j} \wedge e_{2j} \subseteq t_{1j} \wedge$
 $u_{3j} = \text{sue} \wedge \text{clean.our.house}(u_{3j}, e_{2j}) \wedge e_{2j} < t_{2j}$

According to the meanings above, there is a time interval before the speech time that is May 12th, 1984. A house-cleaning event took place within this interval. Moreover, a time after this event is introduced and, as will be seen shortly, serves as an antecedent for the hiring event described later in the discourse.

To finish the derivation of (28), I will concentrate on the meaning of *that same day*. I disregard the meanings of the other expressions in (28)b because they are on a par with those in (28)a discussed above. As illustrated in (40) below, I propose that *that same day* checks in the input context whether there is a time antecedent t_1 that has the property of being a day and takes place throughout a previously introduced time t_2 (within which the described event takes place).²⁵

- (40) $[_{AdvP} \text{ that same day}_{t_1, t_2}] \rightsquigarrow \lambda Q. [\mid \text{day}\{t_1\}, t_2 \subseteq t_1] ; Q(t_2)$

Relating (40) to the discourse at hand, we derive:

- (41) $[t_1, e_2, t_2, u_3, e_4, t_4, u_5 \mid$
 a. $t_1 = \text{may.12.1984}^\circ, t_1 < t_0, e_2 \subseteq t_1, u_3 = \text{sue}^\circ,$
 $\text{clean.our.house}\{u_3, e_2\}, e_2 < t_2,$
 b. $\text{day}\{t_1\}, t_2 \subseteq t_1, t_1 < t_0, e_4 \subseteq t_2, \text{wife.of.speaker}\{u_5\},$
 $\text{hire}\{u_5, u_3, e_4\}, e_4 < t_4]$

This formula could be reduced to (42) below, according to which a hiring event took place within a time after the house-cleaning event, which itself

²⁵Muffy Siegal (p.c.) provides (i) below, which prima facie seem to present a challenge for this view. This discourse is felicitous even though it does not (explicitly) describe a day that could serve as an antecedent for *that same day*. The view advocated here is that in such instances, one accommodates an antecedent of the right kind, i.e. one that has the property of being a day. For example, in (i), one accommodates that *that same day* refers to a day three weeks ago analogous to the way one accommodates in (ii) that *the same town* refers to a town in Wisconsin. Evidence that accommodation is involved in (i) comes from (iii), which is infelicitous because it is unlikely that one could read a lengthy novel in a single day and thus one cannot accommodate that *that same day* refers to some day three weeks ago (when John read ‘War and Peace’).

- (i) Three weeks ago, Sue gave Fido a bath and cleaned our house. That same day, my wife hired her and gave her a check for one month in advance.
- (ii) I went to Wisconsin and bought a car. In the same town, there was a fire (Ted Fernald, p.c.).
- (iii) 3 weeks ago, John read *War & Peace*. #That same day, Sue gave birth.

took place within May 12th, 1984. From this, it follows that the hiring took place both on May 12th, 1984 and after the house cleaning. This is the desired result.

- (42) $[t_1, e_2, t_2, u_3, e_4, t_4, u_5 \mid$
 a. $t_1 = \text{may.12.1984}^\circ, t_1 < t_0, e_2 \subseteq t_1, u_3 = \text{sue}^\circ,$
 $\text{clean.our.house}\{u_3, e_2\}, e_2 < t_2,$
 b. $t_2 \subseteq t_1, e_4 \subseteq t_2, \text{wife.of.speaker}\{u_5\}, \text{hire}\{u_5, u_3, e_4\}, e_4 < t_4]$

In sum, the analysis of (26), repeated below in (43), relies on the idea that *that same day* is ‘twice anaphoric’: it encodes two anaphoric DREFs without introducing one of its own. One of these anaphors is resolved to a time introduced by *on May 12th, 1984* (namely t_1 in (28)a) and the other is resolved to a time introduced by PFV (namely t_2 in (28)a). The latter resolution preserves the narrative progression triggered by PFV that would be present without *that same day*. The coindexation in (28) is, therefore, crucial to obtain the desired reading of (43).

- (43) a. On May 12, 1984 Sue cleaned our house.
 b. That same day, my wife hired her.

To that end, note that two other coindexations are conceivable, e.g. those in (44)-(45) below. While (44)a and (45)a are the same as (28)a, (44)b and (45)b are crucially different from (28)b. In particular, the two anaphoric DREFs encoded by *that same day* in (44)b are both resolved to the time that is introduced by PFV, namely t_2 , while the two anaphoric DREFs encoded by *that same day* in (45)b are both resolved to the time that is introduced by *on May 12th, 1984*, namely t_1 .

- (44) a. $[\text{TP}[\text{AdvP on May 12}^{\text{th}} 1984^{t_1}][\text{TP PST}[\text{AspP PFV}^{e_2, t_2}[\text{VP Sue}^{u_3} \text{clean our house}]]]]$
 b. $[\text{TP}[\text{AdvP that same day}_{t_2, t_2}][\text{TP PST}[\text{AspP PFV}^{e_4, t_4}[\text{VP my wife}^{u_5} \text{hire her}_{u_3}]]]]$
- (45) a. $[\text{TP}[\text{AdvP on May 12}^{\text{th}} 1984^{t_1}][\text{TP PST}[\text{AspP PFV}^{e_2, t_2}[\text{VP Sue}^{u_3} \text{clean our house}]]]]$
 b. $[\text{TP}[\text{AdvP that same day}_{t_1, t_1}][\text{TP PST}[\text{AspP PFV}^{e_4, t_4}[\text{VP my wife}^{u_5} \text{hire her}_{u_3}]]]]$

The coindexation in (44) corresponds to a reading in which the hiring took place after the house cleaning, but not necessarily on May 12, 1984, i.e. a situation in which the house cleaning took place on May 13, 1984 would verify the truth-conditions of (44). We correctly predict this reading to be unavailable in (43) given the semantics of *that same day*, which requires one of the anaphoric times to have the property of being a day and therefore rules out (44).

The coindexation in (45), on the other hand, corresponds to a ‘neutral reading’, i.e. one in which there is no order that the events described in (43)a,b are understood to have occurred in. While the neutral reading is also unavailable in (43), and below I discuss why this is so, note that there is no possible coindexation that would force a reading of (43) in which the hiring took place *prior* to the house cleaning (i.e. narrative regression). That is, the proposed semantics not only predicts that there should be narrative progression in (43) (given the indexation in (28)) and neutrality with respect to event ordering (given the indexation in (45)), but it also

rules out narrative regression given: (a) the semantics of PFV, which moves the narrative forward and (b) the proposed semantics of *that same day*, which can be transparent to the forward movement. This is an important result, since, as we have seen, a problem with Partee's theory is that temporal locating adverbs are never transparent and therefore her theory does not rule out the possibility of narrative regression in (43).

Let us now return to the observation that the coindexation in (45) is not ruled out even though it predicts a neutral reading that is unavailable in (43). To see that this is the desired result, recall that *that same day* and related adverbs are found in contexts in which a neutral reading is salient. For example, the most salient reading of (46) is one in which there is no order that the events described in (46)b,c are understood to have occurred in.

- (46) a. Bill will move next week.
 b. Last week, his house burned down.
 c. That same week he divorced Sue.

In the literature on discourse coherence, (46) would be said to exemplify PARALLEL, defined by Hobbs (1990: 93) as follows:

- (47) PARALLEL(φ , ψ): Infer $p(a_1, a_2, \dots)$ from the assertion of φ , and $p(b_1, b_2, \dots)$ from the assertion of ψ , where a_i and b_i are similar for all i .

The definition in (47) is satisfied by (46)b,c since there is a common predicate p , e.g. *loss*, whose arguments are similar: (46)b describes Bill's loss of a house and (46)c describes Bill's loss of his wife. A house and a wife are similar in, e.g. being vital to one's everyday life. In turn, this parallel is what connects (46)b,c to (46)a via EXPLANATION (defined in section 2.2), i.e. the loss of a house and a wife are parallel in that they both explain why Bill will move next week.

- (48) Coherence structure of (46)
 $[\text{EXPLANATION (46)a} + [\text{PARALLEL (46)b} + \text{(46)c}]]$

Unlike in (46)b,c, it is very difficult (if not impossible) to establish PARALLEL between (43)a and (43)b, i.e. any situation in which (43) is true and in which (43) satisfies (47) is one that is far-fetched. The same is true with respect to any other coherence relation that fails to establish a temporal order between the described events. Such is the case because, as noted in section 2.2, it is very difficult (if not impossible) to think about an event of doing work and an event of being hired—described in the same discourse—without establishing a contingency relationship between the two events. Connecting this intuition to the theory at hand, we can say that that anaphora resolution reduces to satisfaction of constraints imposed by coherence relations: it can look at many anaphors at once and can appeal to world knowledge, especially when there is a lot of content available. In (43), world knowledge reasoning leads us to infer that OCCASION or EXPLANATION—and crucially not PARALLEL—hold in (43)a,b. Given that EXPLANATION (which leads to narrative regression) is ruled out for semantic reasons noted above, it is not surprising that

OCCASION is chosen, i.e. anaphora is resolved as is indicated by (28). In this way, we explain why we infer the particular ordering of events, while being precise about the division of labor between the semantics and the pragmatics module.

I end this section by returning to the discourse in (46) above, where PARALLEL is chosen over OCCASION. I would like to show how the coindexation in (49) below correctly predicts that there is no order that the house burning and the divorce are understood to have occurred in, though both are understood to precede Bill's future move. Subsequently, I consider alternative coindexations and explain why they are ruled out.

- (49) a. $[_{TP}[_{AdvP} \text{ next week}^{t_1}][_ {TP} \text{ FUT}[_{AspP} \text{ PFV}^{e_2, t_2}[_{VP} \text{ Bill}^{u_3} \text{ move}]]]]]$
 b. $[_{TP}[_{AdvP} \text{ last week}^{t_4}][_ {TP} \text{ PST}[_{AspP} \text{ PFV}^{e_5, t_5}[_{VP} \text{ his}_{u_3} \text{ house burn down}]]]]]$
 c. $[_{TP}[_{AdvP} \text{ that same week}_{t_4, t_4}][_ {TP} \text{ PST}[_{AspP} \text{ PFV}^{e_6, t_6} [_{VP} \text{ he}_{u_3} \text{ divorced Sue}^{u_7}]]]]]$

The representation in (49) has four new expressions worthy of note—FUT and *next week* in (49)a, *last week* in (49)b and *that same week* in (49)c—whose semantics are provided below. For the sake of brevity, I will only provide DRT abbreviations from here on out.

- (50) $[_T \text{ FUT}] \rightsquigarrow$
 $\lambda Q \lambda t. [| t_0 < t] ; Q(t)$
- (51) $[_T \text{ next week}^{t_1}] \rightsquigarrow$
 $\lambda Q. [t_1 | \text{week}\{t_1\}, t_0 < t_1], [t' | t_0 < t' < t_1] \Rightarrow [| \neg[\text{week}\{t'\}]] ; Q(t_1)$
- (52) $[_T \text{ last week}^{t_4}] \rightsquigarrow$
 $\lambda Q. [t_4 | \text{week}\{t_4\}, t_4 < t_0], [t' | t_4 < t' < t_0] \Rightarrow [| \neg[\text{week}\{t'\}]] ; Q(t_4)$
- (53) $[_{AdvP} \text{ that same week}_{t_4, t_4}] \rightsquigarrow$
 $\lambda Q. [| \text{week}\{t_4\}, t_4 \subseteq t_4] ; Q(t_4)$

According to (50), the future operator is just like its past counterpart except that it is the mirror image; it checks in the input context whether a time (later saturated by an adverbial expression) takes places after the speech time. According to (51), *next week* introduces a new time t_1 such that it: (i) has the property of being a week, (ii) follows the speech time, and (iii) is the closest week to the speech time (i.e. if there is a time t' that is closer to the speech time than t_1 , then t' does not have the property of being a week). As shown in (52), *last week* is the mirror image of *next week*. Finally, the meaning of *that same week* in (53) is the same as *that same day* with the caveat that it requires that a time in the input context have the property of being a week rather than a day.

Given the meanings in (50)-(53) above, as well as the meanings discussed at the outset of this section, it follows that (49) has the representation in (54) below, where some of the superfluous conditions have been taken out. The superfluous conditions ‘week $\{t_4\}$ ’ and ‘ $t_4 \subseteq t_4$ ’ in (54)c remain to illustrate the contribution of *that same week*.

- (54) $[t_1, e_2, t_2, u_3, t_4, e_5, t_5, e_6, t_6, u_7 |$
 a. $\text{week}\{t_1\}, t_0 < t_1, [t' | t_0 < t' < t_1] \Rightarrow [| \neg[\text{week}\{t'\}]]],$
 $u_3 = \text{bill}^\circ, \text{move}\{u_3, e_2\}, e_2 < t_2,$

- b. $\text{week}\{t_4\}, t_4 < t_0, [t' \mid t_4 < t' < t_0] \Rightarrow [\neg[\text{week}\{t'\}]]$
 $\text{burn.down}\{\text{house.of.}u_3, e_5\}, e_5 < t_5,$
- c. $\text{week}\{t_4\}, t_4 \subseteq t_4, e_6 \subseteq t_4, u_7 = \text{sue}^\circ, \text{divorce}\{u_3, u_7\}, e_6 < t_6]$

According to the truth conditions above, Bill will move the week after the speech time. The week prior to the speech time, his house burned down and he got divorced. Given the aforementioned conditions in (54)c, namely $\text{week}\{t_4\}$ and $t_4 \subseteq t_4$, nothing is said about how the divorce is related in time with respect to the house burning. That is, the contribution of *that same week* reduces to locating the divorce within the same week as the house burning. This is the desired result.

The difference in what is contributed by *that same week* in (54)c and what is contributed by *that same day* in (28)b has to do with the coindexation: while (54)c results from *that same week* encoding time anaphors that have the same antecedent, namely the time introduced by *last week*, (28)b results from *that same day* encoding time anaphors that have the distinct antecedents, namely the time introduced by *May 12th, 1984* and PFV. Since we have already justified the latter resolution, let us turn to justify the former. To do so, let us consider possible antecedents for the two anaphoric times encoded by *that same week*. Given (53) one of these times must have the property of being a week. Looking back to (49), there are only two candidates: the time t_1 introduced by *next week* and the time t_4 introduced by *last week*. With regard to the other anaphoric time encoded by *that same week*, there are two candidates in addition to those already noted: the time t_2 introduced by PFV in (49)a and the time t_5 introduced by PFV in (49)b. Given these options, we have the following alternatives to (49)c:

- (55) a. $[\text{TP}[\text{AdvP } \text{that same week}_{t_1, t_1}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$
 b. $[\text{TP}[\text{AdvP } \text{that same week}_{t_1, t_2}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$
 c. $[\text{TP}[\text{AdvP } \text{that same week}_{t_1, t_4}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$
 d. $[\text{TP}[\text{AdvP } \text{that same week}_{t_1, t_5}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$
 e. $[\text{TP}[\text{AdvP } \text{that same week}_{t_4, t_2}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$
 f. $[\text{TP}[\text{AdvP } \text{that same week}_{t_4, t_5}][\text{TP } \text{PST}[\text{AspP } \text{PFV}^{e_6, t_6} [\text{VP } \text{he}_{u_3} \text{divorced Sue}^{u_7}]]]]]$

The coindexations in (55)a-(55)e are ruled out by the semantics. In particular, (55)a-(55)d require one of the anaphoric times encoded by *that same week* to be resolved to a future time t_1 introduced by *next week*. This is in conflict the meanings of PST and *that same week*, i.e. we would predict the contradictory claim that a time in the past to took place within the future time t_1 . In (55)e, the anaphoric times encoded by *that same week* are resolved to a past time t_4 introduced by *last week* and future time t_2 introduced by PFV. As with (55)a-(55)d, this conflicts with the semantics of *that same week*, i.e. we would predict the contradictory claim that the future time t_2 took place within the past time t_4 .

The coindexation in (55)f, on the other hand, is compatible with the semantics. It would lead to an interpretation on a par with the discourse considered at the outset of this section, in (43) above. That is, (55)f requires that the divorce and the house burning not only took place during the same week, but the former took place after the later. As before, such

an inference could be justified via OCCASION, which would mean that the divorce was contingent on the house burning. On the face of it, this is unlikely—hence the preference for the coindexation in (49)c, which is compatible with PARALLEL. However, it is conceivable that, e.g. it was Sue’s fault that the house burned down (she forgot to turn off the stove!) and this mishap was the final straw in their already troubled relationship—Bill decided to divorce Sue. In such a context, the discourse in (46), repeated below in (56), would have the discourse structure in (57), which is predicted by the coindexation in (55)f above.

- (56) a. Bill will move next week.
 b. Last week, his house burned down.
 c. That same week he divorced Sue.
- (57) Coherence structure of (62)
 [_{EXPLANATION} (56)a + [_{OCCASION} (56)b + (56)c]]

In sum, the proposed semantics of tense and *that same week* rules out most of the coindexations that are alternative to (49)c. The lone alternative that is not ruled out by the semantics is less likely—on pragmatic grounds—but it nevertheless possible. In this way, we account for the discourse in (56), and more generally discourses with *that same day* and related adverbs.

4 “Currently”

In the previous section, I proposed that *that same day* and related adverbs are ‘twice anaphoric’: they encodes two anaphoric DREFs without introducing one of their own. As summarized in Fig. 3 below the fact that *that same day* does not introduce a DREF sets it apart from other temporal locating adverbs discussed at the outset. For example, when comparing *that same day* with *the day after*, the inability of the former to introduce a DREF is a distinguishing property since both adverbials are [+anaphoric] and [-deictic]:

	CAN BE ANAPHORIC?	CAN BE DEICTIC?	INTRODUCE DREF?
<i>May 12, 1984</i>	No	No	Yes
<i>Yesterday</i>	No	Yes	Yes
<i>the day after</i>	Yes	No	Yes
<i>that same day</i>	Yes	No	No
<i>on Sunday</i>	Yes	Yes	Yes

Fig. 3 Typology of temporal adverbs (to be revised)

The goal of this section is to propose that *currently* is another temporal locating adverb that does not introduce a DREF. This adverb differs from *that same day*, however, in its ability to have a deictic interpretation (in addition to an anaphoric one). That is, *currently* is analogous to *on Sunday* in being [+anaphoric] and [+deictic]. In passing, I also discuss the related adverb *now* and end the section by discussing a

challenge that *currently* presents for the interface between adverbial and aspectual meaning.

In discourse initial contexts, *currently* can only be used to describe the speech time. Therefore, it is not surprising that it typically appears with the present tense when used discourse initially:²⁶

- (58) I am **currently** acting as the Administrator in the transition from the Bush to the Clinton administration (M. Berry 1993: *Racial and Ethnic Tensions in American Communities: Poverty, Inequality, and Discrimination—Los Angeles Hearing*).

Here *currently* does not seem to contribute to the assertion beyond what is already contributed by the present tense. That is, (58) appears to be truth conditionally equivalent to (59):²⁷

- (59) I am acting as the Administrator in the transition from the Bush to the Clinton administration.

Looking at *currently* in sentences like (58) one would likely conclude that this adverb is a deictic expression. Possible support for this position comes from the parallel between Hans Kamp's influential example with *now* in (60) and the example with *currently* in (61):

- (60) I learned last week that there would **now** be an earthquake (Kamp 1971: 299).

- (61) I asked whether he would **currently** judge them to be fact...(R. de Mille 2000, *The Don Juan Papers: Further Castaneda Controversies*).

Saying that *now* and *currently* always refer to the context of utterance would explain why (60) and (61) entail that the described eventualities (i.e. there being an earthquake in (60) and a man's belief about some facts of the matter in (61)) hold at the speech time even though there is no present tense in either sentence; this entailment disappears without *now* and *currently*, respectively.

In contrast to Kamp (1971), Altshuler (2009, 2010) proposed the following reanalysis of (60): *now* requires a salient time antecedent and the speech time must be chosen because it is compatible with the semantics of *would* and there is no other possible antecedent; the time of the learning event (i.e. a week before the speech time) described by the matrix clause is

²⁶ Alice ter Meulen (p.c.) observes that *currently* seems to be ok in a discourse-initial, past conditional statement such as "Had I been aware of this currently, then..." Note, however, that *currently* picks out the speech time in such an example.

²⁷ The adverb may appear to contribute a contrast to the effect that the speaker was not acting as the administrator prior to the transition. This contrast could be contributed by the pitch accent on *currently* (cf. *THIS YEAR I am acting as the administrator, but LAST YEAR I was not*) or the mere usage of the adverb, i.e. the hearer may calculate an implicature based on the speaker saying (58) and not (59).

ruled out because *would* requires the earthquake to follow this event.²⁸ Similarly, we could say that the speech time must be chosen as the antecedent in (60) because the only other possible antecedent, the time of the asking, is ruled out by the semantics of *would*.

Evidence for this view comes from cases in which *now* and *currently* occur in past tensed sentences embedded within a discourse. According to the British National Corpus, this is the most common usage of *now* (Lee 2010) and *currently* is also used in this way. Consider (62) and (63) below. In (62), Kamp's example is embedded within a made-up story. In (63), the example with *currently* is embedded within an actual passage from *The Don Juan Papers: Further Castaneda Controversies*. Interestingly, we understand *now* in (62) to refer to the time that Victoria begins to look nervous rather than the speech time. Similarly, in (63), *currently* refers to the time of the writing, in March 1978, and not the speech time.

(62) ...Victoria began to look nervous, thought Jenya. She was shaking and paced back and forth. Apparently, she learned last week that there would **now** be an earthquake.

(63) In March 1978 I wrote a letter to Mehan citing published opinions that the works he had adduced in support of his hypothesis were entirely or mostly fiction. I asked whether he would **currently** judge them to be fact...(R. de Mille 2000, *The Don Juan Papers: Further Castaneda Controversies*).

A similar anaphoric usage of *currently* is found in (64) with the auxiliary *will*. It refers to a future time, namely the time of a conceived discussion about social issues that the students may be having at that time.²⁹

(64) Teachers could have small groups of students lead discussion about the social issues in their assigned young adult text and how these issues are relevant to the students' lives...Teachers have to anticipate the fact that at least one of the students in the class will **currently** be dealing with the sexual issue they are discussing (P. Carroll 1999, *Using Literature to Help Troubled Teenagers Cope with Societal Issues*).

In sum, the data above suggests that *currently* is an anaphoric expression: it requires a salient time antecedent that could be in the past, present or future and—if no grammatical elements (e.g. the present tense)

²⁸ To the best of my knowledge, the idea that *now* has anaphoric properties is due to Kamp & Rohrer 1983. See also Kamp & Reyle's (1993) analysis of *now* as a perspective seeking anaphor and more recently, work by Julie Hunter (Hunter 2010, 2012).

²⁹ The examples below provide examples parallel to (63) and (64) respectively:

(i) Back on the beach, another cocktail in hand, I saluted a fiery orange sun as it slipped into the ocean. I knew there would **currently** be another group of climbers on Kilimanjaro, eagerly awaiting its return (M. Elliot 2001, *Intrepid Africa*).

(ii) After clicking on the new project we will be prompted for what kind of testing we are looking at, i.e., load testing, general testing, etc. **Currently**, we will select only General-Purpose Test project (S. Koirala and S. Sheikh 2008, *Software Testing*).

indicate otherwise—independent rules of anaphora resolution determine which one is chosen. Within the framework introduced in the previous section, I propose that *currently* has the meaning below; its semantic function is to saturate the time argument of the tense by checking in the input context that there is a salient time.

$$(65) [{}_{\text{AdvP}} \text{currently}_{t_n}] \rightsquigarrow \lambda Q. [| t_n] ; Q(t_n)$$

Before turning to illustrate how (65) allows us to capture the aforementioned intuitions about the data discussed in this section, it is worthwhile to entertain the idea that *currently*'s occurrence with the past tense could be explained by recent proposals of so-called *shifted indexicals*. One such analysis comes from Schlenker (2004), who—following Banfeld (1982) and Doron (1991)—proposes that indexicals should be evaluated relative to two contexts, which Schlenker calls ‘the context of thought’ and ‘the context of utterance’. The former is the context from which a given thought is taken to originate and the latter is the context in which the thought is expressed. According to Schlenker, temporal indexicals like *now* are given their values by the context of thought, which may differ from the context of utterance.

On this view, we could say that in (63) and (64) an operator shifts *currently*'s context of thought coordinates to a past and future time respectively. This view is attractive insofar as it has been argued on independent grounds that such shifting operators are necessary (see e.g. Kamp 1999/2013, Schlenker 1999). However, note that the motivation for shifting operators comes from data involving propositional attitude reports across languages (e.g. Anand & Nevins 2004, Deal 2012) and free indirect discourse (Schlenker 2004, Sharvit 2008), i.e. cases in which the ‘perspective’ shifts from the narrator to the attitude holder or character in a novel. Since *currently* often refers to a time other than the speech time in non-attitude and non-free indirect discourse contexts—e.g. (63) and (64) do not exemplify instances of free indirect discourse and as we shall see shortly, *currently* need not be embedded under an attitude in its past tense usages—an analysis of this adverb that involves shifting operators cannot be the whole story.³⁰

Let us then return to the proposed meaning of *currently* in (65) above and show how it allows us to account for the various data discussed in this section. We begin with the present tense usages of *currently*. The meaning in (65) allows us to represent the simplified version of (58) as follows:

(66) I am currently acting.

(67) ${}_{\text{TP}} [{}_{\text{AdvP}} \text{currently}_{t_0}] [{}_{\text{TP}} \text{PRS} [{}_{\text{AspP}} \text{PROG}^{e_1} [{}_{\text{VP}} \text{I}_{t_0} \text{act}]]]$

³⁰ Hunter (2010) makes a similar point with respect to *now*. She argues that accounts such as Banfeld's (1982) and Doron's (1991) and Schlenker's (2004) “cannot possibly do justice to the full range of behavior exhibited by *now*. They may very well shed light on certain aspects of particular literary styles...but we must look beyond them to construct a full semantic account for *now*...The real shortcoming of all of these views...is that *now* can pick up on a time other than the time of actual utterance even outside of the historical present and free indirect discourse” (*ibid*: 56).

Several comments are in order. To begin with, I assume following Bittner (2007) that “As soon as somebody begins to speak, this very fact is noted, focusing the attention on three default topics.”³¹ In DRT terms, we can represent this focus of attention as an initial DRS (*start up update* in Bittner’s terms), which for our purposes will be represented as in (68) below: the interpretation of any given discourse involves an introduction of the following three DREFs in the initial DRS: (i) t_0 , which describes a constant function (of type si) from environments to the speech time, (ii) e_0 , which describes a constant function (of type sv) from environments to the speech eventuality and (iii) u_0 , which describes a constant function (of type se) from environments to the speaker.³² This ensures that the speech time, the speech eventuality and the speaker are always accessible (cf. van Eijck & Kamp 1996).

$$(68) [t_0, e_0, u_0 \mid \text{speak.up}\{u_0, e_0\}, \tau\{e_0\} = t_0]$$

Note that the representation in (67) above already presupposes (68): *currently* is coindexed to the speech time and *I* is coindexed with the speaker. When the meaning of (67) is merged with (68), we obtain:³³

$$(69) [t_0, e_0, u_0 \mid \text{speak.up}\{u_0, e_0\}, \tau\{e_0\} = t_0, t_0 \subseteq e_1, \text{act}\{u_0, e_1\}]$$

According to (69), the eventuality of the speaker acting takes place throughout the speech time. This is in accordance with what (66) asserts.

Let us now move on to account for the infelicity of discourse initial uses of *currently* with the past and future tense:

(70) #I was currently acting.

(71) #I will be currently acting.

Given the analysis of (66) sketched out above, the infelicity of (70) and (71) is expected because there is no possible coindexation that could satisfy both the anaphoric presupposition of *currently* and that of PST and FUT respectively. Recall that the meaning of PST and FUT require that the input context contain a past and future time respectively. Adverbs such as *yesterday* and *tomorrow* satisfy these requirements respectively by introducing new DREFs that saturate the time argument of a given tense operator. *Currently*, however, does not introduce a new DREF, but rather imposes the requirement that there be a salient time in the input context. As we have seen in the analysis of (66), the initial DRS can provide such a time, namely the speech time. However, while this satisfies the anaphoric

³¹ Bittner adopts this idea from Stalnaker’s (1978) *Commonplace effect*. See Hunter 2010 for a similar proposal.

³² Bittner’s three topics are the speech world, the speech event and the speech time. The speaker is modeled as the agent of the speech event. These differences are not significant for the purposes here.

³³ Note that the condition $t_0 \subseteq e_1$ comes from the meaning of the progressive operator, PROG. This is a gross simplification since it does not account for the imperfective paradox (see Dowty 1979, Landman 1992, Bonomi 1997, Portner 1998, among many others). This issue is beyond the scope of this paper; see Bary 2009 and Altshuler 2012, for analyses which incorporate modal properties of aspectual operators within CDRT.

presupposition of PRS, it does not satisfy the anaphoric presupposition of PST and FUT.

The analysis of *currently* in discourse initial contexts is important because it allows us to extend our analysis to adverbless sentences such as (72) below:

(72) #Seth planted roses (Smith 1977: 568).

Smith (1977) observed that the sentence in (72) ‘does not give enough information for temporal interpretation’ when uttered discourse initially. According to Smith, ‘a full interpretation’ of...[(72)]...is only possible in a context that provides enough linguistic or extralinguistic information (*ibid*: 571). Smith’s position is reiterated by Kamp and Reyle (1993), who write: “While it is a convention of narrative fiction that the first sentence need not be anchored to some specific reference time, the first sentence of a discourse concerning the affairs of this world, in particular when it concerns our daily lives, is in general not free of this constraint . . .’ (*ibid*: 529). In light of this view, it is not surprising that (73) and (74) below are much more natural than (72) when uttered discourse initially. That is, unlike in (72), the event described in (73) is located within a specific reference time, namely the time described by *yesterday*. Moreover, unlike in (72), it is quite easy to accommodate the reference time in (74) as being in the very recent past.

(73) Seth planted roses yesterday.

(74) I didn’t turn off the stove (Partee 1973: 602).

Ever since Partee (1973), the idea has been to say that (72) is no good because tense is pronoun-like, requiring an antecedent (e.g. Heim 1994, Kratzer 1998, Kusumoto 1999, von Stechow 2002), or it is quantifier-like, where the domain of quantification makes explicit reference to prior discourse (e.g. von Stechow 2009, Altshuler & Schwarzschild 2013).³⁴ The idea pursued here, however, is that adverbs serve as the link to prior discourse. In particular, I propose that some episodic sentences in the past tense that do not have an overt temporal locating adverb in the syntax have a silent ‘currently’ operator present in the logical form. This allows us explain the infelicity of sentences like (72) in the same way as (70) above: there is no possible coindexation that could satisfy both the anaphoric presupposition of *currently* and that of PST. With regard to (74), we preserve Partee’s original insight that indirect time specification comes from accommodating a presupposition of uniqueness of a time in the recent past.³⁵ The difference from Partee’s analysis is that the presupposition is directly related to the semantics of *currently* and PST.

Note that unlike the data just discussed, (75)-(76) cannot be explained

³⁴ Recall the discussion in section 2.2.

³⁵ As noted by Barbara Partee (p.c.), the examples in (i)-(ii) could also be analyzed in this way, namely as involving accommodation of a presupposition of uniqueness of the time of going to college and the time of being born respectively.

(i) My father was born in Burlington, VT.

(ii) Seth went to Swarthmore.

by a *currently* operator. Here, we don't understand there to be a unique time of birth and speaking loudly respectively. Instead, we have implicit universal quantification over times.

(75) God's children were born evil.

(76) I speak loudly in public.

Such data suggest that there could be other silent adverbial operators involved or perhaps that there is a universal quantifier present in the logical form of (75)-(76) that has scope over *currently*. In either case, the analysis presented here can be thought of as an extension of Smith 1977:³⁶

(77) "There is an important difference between the syntax and semantics of temporal specification. Tense is the only temporal expression that is necessary in a sentence that is syntactically well formed; but for a sentence to be semantically well-formed, from the temporal point of view, it must have both tense and a time adverbial" (*ibid*: 570).

Let us now move on to analyze *currently* embedded in discourse contexts. The claim here is that like *that same day*, *currently* is transparent to the independent rules that account for the temporal structure of a given discourse. A clear example of this is (78). Whether or not *currently* is present, we understand that establishing order sets up the occasion for Vladimir to be feared and respected by many vampires. Similar transparency is seen in the aforementioned discourses in (63)-(64).

(78) There were a lot of vampires there, followers of Vladimir, although they had a code to keep. They were free and educated, just like the Roswells. They also respected life and only consumed what they needed. Just like what Vladimir had promised Elizabeth before, when she was still human, that we would establish some type of order in the world of vampires. And he did it, and **currently** he was feared and respect by many vampires... (A. Duncan 2010, *Hybrid*).

The transparency in (78) is not surprising if we assume that: (i) the meaning of "did it" involves PFV, which introduces a time that is 'just after' the establishment of some type of order and (ii) *currently* locates the fearing and respect at this this time. If *currently* were not present in (78), I assume that there would a covert 'currently' operator in the logical form that would perform the same function as the overt *currently*.

One question that comes up, given the transparency of *currently*, is: Why does anyone ever use this adverbial? Recall that besides the Kamp-type cases like (61), repeated in (79) below, *currently* does not contribute any information about the temporal location of a described eventuality that would not otherwise be inferred. In this way, *currently* appears to be unlike *that same day*, which although is also transparent to the surrounding discourse structure, nevertheless contributes the additional information that a described eventuality took place on a salient day.

³⁶ See also Bäuerle (1977; 1979), Musan (1997) and references therein.

- (79) I asked whether he would **currently** judge them to be fact...(R. de Mille 2000, *The Don Juan Papers*).

To see that *currently* makes vital contribution in cases other than (79), it is helpful to have a global view of the discourses containing this adverb. For example, consider (80) below. After the narrator asserts that it was finally Tuesday, she shifts into a flashback describing what she had done and what she had felt prior to Tuesday. In order to pick up the narrative where it left off, *currently* is inserted at the beginning of the next paragraph, with the instructions (for the reader) to find the aforementioned salient time, namely the onset of Tuesday. Without *currently* at the beginning of the paragraph, the reader would still likely make the correct inference about the temporal progression in the story. However, *currently* makes the discourse more coherent.

- (80) Tuesday came sooner than I thought it would. Tonight, Damien and I would be meeting Ashlynn's father. In my waiting I had successfully taught Rowland one trick while Damien had taught Tabitha five. Thus far I had managed to keep my possible friendship with Kameron a secret from my brother. I had not worried too much about Ashlynn's arrival.

Currently I was in a fabulous mood... (A. Hengy 2001, *Immortal Secrets: The Tales of Dungard*).

This discourse function of *currently* is perhaps clearest in (81), which is borderline incoherent without this adverb. Here, *currently* is used to locate the divorce and son-raising at the time of the interview. Without *currently*, one is led to the contradictory inference that Carol was married and divorced at the same time.

- (81) Carol was thirty-six at the time of the interview. She had dropped out of high school after becoming pregnant and married at seventeen. **Currently** she was divorced and raising her son on her own with her work as a hairdresser (A. Press 1991, *Women Watching Television: Gender, Class, and Generation in the American Television Experience*).

I end this section by looking at a property of *currently* which remains unexplained by the proposed analysis: it is incompatible with eventive sentences.³⁷ This restriction is exemplified by (82) and (83).

³⁷ Kamp & Reyle 1993 made similar claims about *now*, although Lee & Choi 2009 and Hunter 2010 have shown that *now* is, in fact, often felicitous in eventive sentences. Hunter claims that *now* is only sometimes incompatible with eventive sentences due to principles of discourse coherence. The claim here is that unlike *now*, *currently* is never compatible with eventive sentences, regardless of the discourse structure. A tentative hypothesis is that the semantics of *currently* requires BACKGROUND (as defined in Asher & Lascares 1993) or GROUND-FIGURE (as defined in Hobbs 1990).

- (82) In messages on 3 December, the British and French Governments noted that an effective United Nations Force {#currently arrived/^{OK}was currently ready to arrive/^{OK}was currently arriving}.³⁸
- (83) He developed the Boston Road projects for CVS, Big Y and Red Robin, and {#currently built/^{OK}was currently building} a Hampton Inn and Suites at Founders Plaza.³⁹

The data above are important for several reasons. To begin with, it goes against Katz’s (2003) claim that some adverbs “select against stative verbs and for eventive verbs”, but “there do not seem to be adverbs that select for stative verbs and against eventive verbs.” Katz calls this generalization the “Stative Adverb Gap” (summarized below in (84)), which would be unexpected on most analyses of temporal locating adverbs and certainly on the analysis proposed here.

- (84) STATIVE ADVERB GAP: “if an adverb can felicitously modify a stative verb, then it can also felicitously modify an eventive verb, but not the other way around” (Katz 2003: 2).

On the other hand, the fact that there are, in fact, adverbs that “select for stative verbs and against eventive verbs”, viz. *currently*, raises non-trivial questions about the meaning of these adverbs and, more generally, the interface between adverbial and aspectual meaning. While at the current moment, it is not clear how to account for the data in (82) and (83), one possibility is to say—following Altshuler’s (2009) analysis of *now*—that *currently* saturates the time argument *t* of the aspectual phrase by requiring that *t*: (i) be resolved to a salient antecedent and (ii) describe what took place throughout this time. The first requirement would capture *currently*’s anaphoric nature, while the second requirement leads to a contradiction with eventive, but not stative VPs. More specifically, the idea would be that aspectual constraints on narrative progression imposed by eventive (but not stative) VPs contradict the aspectual-like constraints imposed by *currently*. The hope is that further research will make this idea precise within the theory of temporal interpretation proposed here.

5 Conclusion

There are various proposals about the semantic contribution of temporal locating adverbs. To the best of my knowledge, however, there has not been explicit arguments put forth for which type of a proposal ought to be adopted. The different options can be reduced to whether one, both or neither of the hypotheses below are adopted:

- (85) a. Temporal locating adverbs introduce a new time DREF.
 b. Temporal locating adverbs provide the reference time of the clause in which they occur in.

³⁸ <http://www.un.org/en/peacekeeping/missions/past/unef1backgr2.html>

³⁹ <http://articles.courant.com/keyword/hampden/recent/2>

Partee’s (1984) analysis adopts both (85)a and (85)b, and was shown to be inadequate based on the behavior of *that same day* and related adverbs in narrative discourse. Moreover, I showed that *that same day* poses non-trivial issues for other analyses of temporal locating adverbs—even those that deny (85)a and/or (85)b. Subsequently, I suggested a possible way in which we can make the correct predictions, while maintaining Reichenbach’s original insight in (85)b. In particular, I suggested that we modify (85)a as follows: some, but not all temporal locating adverbs introduce a new time DREF; some merely constrain the temporal location of a described event relative to a salient time (or times) previously introduced into the discourse context. I made this idea explicit within CDRT, showing how meaning of temporal locating adverbs could be integrated within a more general theory of temporal interpretation.

Finally, I proposed a parallel between *that same day* and *currently*: both adverbs constrain the temporal location of a described event relative to a salient time DREF previously introduced into the discourse context without introducing one of its own. *Currently* differs from *that same day*, however, in its ability to have a deictic interpretation in addition to an anaphoric one. That is, *currently* is analogous to *on Sunday* in being [+anaphoric] and [+deictic]:

	CAN BE ANAPHORIC?	CAN BE DEICTIC?	INTRODUCE DREF?
<i>May 12, 1984</i>	No	No	Yes
<i>Yesterday</i>	No	Yes	Yes
<i>the day after</i>	Yes	No	Yes
<i>that same day</i>	Yes	No	No
<i>currently</i>	Yes	Yes	No
<i>on Sunday</i>	Yes	Yes	Yes

Fig. 4 Typology of temporal adverbs (final version)

Acknowledgments

Thanks to Alice ter Meulen, Barbara Partee, Guillaume Thomas and Roger Schwarzschild for providing comments on previous versions of this paper. Thanks to Katja Jasinskaja, Rajesh Bhatt and Sam Cumming for fruitful discussions that lead to many substantial improvements. Thanks to Hans Kamp, Reinhard Muskens and Yael Sharvit for inviting me present the material found here in their research groups and seminars. Thanks to Hana Filip for co-teaching two seminars with me at Heinrich Heine University and a class at ESSLLI 2013. These experiences sharpened my ideas about temporal adverbs and about temporality more generally. Thanks to the participants at the following venues, where work related to this paper was presented: SALT 21 @ Rutgers University; Department of Linguistics & Cognitive Science @ University of Delaware; Institute for Research in Cognitive Science (IRCS) Lab @ University of Pennsylvania; Department of Classics, Modern Languages & Linguistics @ Concordia University; Department of Languages, Literatures & Linguistics @

Syracuse University; Department of Linguistics @ Haverford College. Last but certainly not not least, thanks to Angelika Kratzer, Irene Heim and the anonymous reviewers for NALS, who provided extremely insightful feedback. The usual disclaimers apply.

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