Formal Properties of 'Now' Revisited[*]

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Abstract The traditional view is that 'now' is a pure indexical, denoting the utterance time. Yet, despite its initial appeal, the view has faced criticism. A range of data reveal 'now' allows for discourse-bound (i.e., anaphoric) uses, and can occur felicitously with the past tense. The reaction to this has typically been to treat 'now' as akin to a true demonstrative, selecting the prominent time supplied by the non-linguistic context or prior discourse. We argue this is doubly mistaken. The first mistake concerns the semantic value of 'now', which is not a time, but a state — the consequent state of a prominent event. The second is that 'now' is a pure indexical after all, insofar as its interpretation is determined without recourse to extra-linguistic supplementation. Specifically, we argue that any occurrence of 'now' selects the consequent state of the most prominent event, where event-prominence is linguistically maintained through prominence-affecting updates contributed by coherence relations. Our analysis accounts straightforwardly for a wide range of discourse initial and discourse bound uses of 'now', while giving it a simple indexical meaning.

Keywords: 'now', discourse coherence, temporal anaphora, indexicality, context-sensitivity, dynamic semantics, centering

1 Introduction

'Now' has traditionally been analyzed as a pure indexical: given a context it automatically selects the utterance time.[1] This is for a good reason: the data below — which fueled Kamp's seminal work on double indexing — suggest that 'now' selects the utterance time even when other times are introduced by that very utterance (Kamp 1971).

(1)   I learned last week that there would now be an earthquake.

1 The notion of a "pure indexical" goes back to Kaplan (1989), who contrasts it with "true demonstratives," the linguistic meaning of which is incomplete, requiring extra-linguistic supplementation.

(2)   I learned last week that there would be an earthquake.

'Now' in (1) references the utterance time even though the sentence does not feature present tense, and even though 'now' occurs within the complement clause of a past tensed verb. Unlike (1), (2) can be true even if the earthquake preceded the utterance. Hence, the anchoring to the utterance time in (1) is traced to the contribution of 'now'. What explains the contrast is that 'now' selects the utterance time, not just some time in the future of the learning event.

Despite its initial appeal, the pure indexical view has been forcefully challenged. Given the right set-up, 'now' can fail to select the utterance time; it allows for anaphoric (i.e., discourse-bound) uses (Dry 1979, Kamp & Rohrer 1983, Kamp & Reyle 1993, *inter alia*). In fact, it turns out 'now' most frequently occurs with the past tense in English (Lee 2010); for instance:[2]

(3)   Within a couple of minutes a huge male tiger—later to be identified as 'Budha Bapp'—emerged from behind some rocks and bushes and lay down in a clearing close beside her. **The tigress now got up again** as if in a half daze…(*Wild Experiences*, Gupta.)

(4)   Faith and Hope were both perched on the plaster ledge made by the gap in the ceiling. One after another, they pitched forward and flew out. **The room was empty now**. (*One Pill Makes You Smaller: A Novel*, Dierbeck)

(5)   He stopped talking to his friends because **he was now a big shot politician** who didn't want to mix with the *hoi polloi*.[3]

Our main aim is to offer a uniform account for the different uses of 'now', focusing on the deictic and discourse-bound uses above. The latter may seem damning for the pure indexical account of 'now'. At minimum, the linguistic meaning of 'now' cannot automatically select the utterance time, as Kaplan (1989) and Kamp (1971) maintained. Moreover, if 'now' selects a contextually prominent value, as suggested by (3)-(5), and if prominence is a matter of complex contextual factors, including non-linguistic factors (e.g., real-world salience, plausibility, speaker intentions), then this account is doubly wrong: 'now' neither selects the utterance time, nor is it a pure indexical. It's akin to true demonstratives, e.g. 'he.'[4]

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2 Note that we cannot explain all anaphoric uses as free indirect discourse or perspective shift. Dry (1979) observes that 'now' often appears within historical narrative. See Hunter 2010 for further arguments.

3 Thanks to an anonymous reviewer for this example.

4 But doesn't 'now,' when not discourse-bound, automatically select the utterance time (unlike 'he,' which can have different deictic interpretations)? We shall see, the account on which 'now' automatically selects the utterance time is oversimplified even for its non-anaphoric uses.

While we agree the data show that 'now' cannot simply select the utterance time, we disagree that it is not a pure indexical. We can provide an empirically adequate, uniform theory of 'now', capturing its various uses, while nevertheless treating 'now' as a *pure indexical*, in Kaplan's sense, albeit a *prominence-sensitive* one, in the sense of Stojnić et al. (2013, 2017), Stojnić (2021). We approach our inquiry through two questions:

(i) What is the linguistic meaning of 'now' (i.e., its *character*, using Kaplan (1989)'s jargon)?

(ii) How is the content of 'now' determined in context?[5]

We address (i) by building on our previous work, proposing that 'now', as a matter of its linguistic meaning, selects a *state*, not a *time*.[6] Specifically, we maintain that 'now' selects the consequent state of a prominent event, where prominence is contextually determined. This brings us to (ii). Assuming we are right that 'now' selects the consequent state of a prominent event, what makes a particular event prominent? We argue that this, and so the interpretation of 'now', is determined by prominence-affecting linguistic mechanisms. We propose to model context as a dynamically evolving prominence ranking of candidate interpretations. The ranking is maintained through grammatically encoded re-ranking updates contributed by linguistic mechanisms: coherence relations.[7] As a matter of its meaning, 'now' simply selects the most prominent candidate interpretation, as reflected by the current ranking. So, while 'now' does not select the utterance time, it nevertheless has its meaning fixed automatically as a function of (the current state of) the context. Since the state of the (relevant parameter of) context at any point in the discourse is determined by the grammatical contribution of coherence relations, the interpretation of 'now' is solely determined by linguistic means. It is in this sense, we submit, that 'now' behaves as a pure indexical.[8]

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5 An answer to (i) doesn't automatically provide an answer to (ii). If the character were incomplete, as in the case of true demonstratives, we would still need to say what further contextual supplementation is required to determine the content given the character.

6 The proposal is first developed in our Altshuler & Stojnić 2015, reported by Altshuler (2016: ch. 2), Carter & Altshuler (2017) and Altshuler (2020).

7 Here, we build on Stojnić et al. 2013, 2017, Stojnić 2016, 2017, 2018, Stojnić 2021.

8 We don't want to police terminology. What matters is that 'now' has its meaning linguistically determined as a function of (a linguistically maintained) context. If 'now' selected a prominent candidate interpretation in context, but prominence were fixed not linguistically, but through an open-ended set of cues (e.g., speaker intentions, plausibility, relevance), that would not be a pure indexical account in our sense; the content of 'now' in context would be *linguistically* underdetermined. It is this latter type of view we argue against.

We are not the first to propose that mechanisms of discourse structure affect the interpretation of 'now'. Hunter (2010, 2012) argued that coherence relations play a vital role in resolving the antecedent for 'now' and proposed that 'now' restricts the coherence relations that hold between a subordinate clause and its super-ordinate antecedent, citing contrasts such as following:

(6)   I hit him today because he hit me last week.

(7)   #I hit him because he now hit me. (Hunter 2012: 15)

More recently, Anand & Toosarvandani (2019) proposed that 'now' is sensitive to the interaction between discourse and information structure. They compare clause-initial 'now' in (8) with the clause-final 'now' in (9), proposing that only the former discourse is understood to exemplify narrative progression because 'now' is used as a contrastive topic.[9]

(8)   People began to leave. Now, the room was empty. (Anand & Toosarvandani 2019: 22)

(9)   The janitor turned off the lights. The room was empty now. (Anand & Toosarvandani 2019: 21)

While these two important proposals emphasize the role of discourse-level mechanisms in interpreting 'now', they differ from ours in how (i) and (ii) are addressed. To the best of our knowledge, our paper is the first to propose and work out a formal treatment of 'now' as a pure indexical by treating linguistic mechanisms of discourse structure as contributing (re-)centering updates.

We proceed as follows. §2 presents the model of prominence developed by Stojnić et al. (2013, 2017), Stojnić (2016, 2018), Stojnić (2021). §2.1 introduces the key elements of the account, while §2.2 shows how it can be independently motivated by, and applied to model, interpretive constraints in the analysis of tense. In §3, we extend this account to 'now'. In §3.1 we do so while making the natural assumption that since 'now' is a temporal adverbial, it selects a time. Given that assumption, we sketch a pair of answers to (i) and (ii) according to which 'now' selects the most prominent time, and the prominence is determined through linguistic mechanisms of discourse coherence. We show that, while such account has many advantages, it fails to explain Hunter's contrast between (6) and (7). In §3.2 we explain the contrast by adopting the view that the semantic value of 'now' is not a time, but a state — the consequent state of a prominent event (Altshuler & Stojnić 2015). We illustrate how our formal system works by applying it to anaphoric (i.e., discourse-bound)

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9 To the best of our knowledge, the first exploration of prosody and placement of 'now' within a clause was by Hirschberg & Litman (1987).

past-tensed uses of 'now' (§3.2.1) as well as discourse-initial (including deictic) uses of 'now' (§3.2.2). (We provide a fragment and some worked out examples in the Appendix (§5).) In §4, we conclude by summarizing our main contributions.

2 Prominence-sensitivity and Discourse Coherence

2.1 Discourse Coherence

Coherence-theoretic accounts start from the observation that discourses are structured into coherent units, contributing more than a random sequence of sentences. For example, (10-a) serves as an explanation of (10), while the odd (10-b) fails to establish this connection.

(10)   John took a train from Paris to Istanbul. (Hobbs 1979)

     a.   He has family there.

     b.   He likes spinach.

Coherence-theoretic accounts explain this observation by positing coherence relations — here, Explanation — in the logical form of the discourse. Explanation organizes (10-a) into more than just a set of unrelated claims about John, and the failure to confirm this relation is what makes (10-b) odd (Hobbs 1978, 1979, Asher & Lascarides 2003, Kehler 2002).

Establishing coherence in a discourse affects the resolution of context-sensitivity (Kehler et al. 2008, Kaiser 2009, *inter alia*). For example, the choice of a coherence relation in (11) affects the resolution of the pronoun. If the discourse is organized by Result (Liz's poking was caused by Phil's tickling), the pronoun is resolved to Phil. If it is organized by Parallel (Liz and Phil's acts were similar) then the pronoun is resolved to Stanley.[10]

(11)   Phil tickled Stanley, and Liz poked him. (Smyth 1994)

Coherence-theoretic frameworks typically characterize such correlations as pragmatic defaults. Presented with (11), the interpreter is tasked with two interrelated, but separate tasks: establishing coherence, and resolving a pronoun. The interpreter works to resolve them by coming up with the overall most plausible interpretation.

Stojnić et al. (2017) challenge this analysis, arguing that it is a mistake to think of (11) as presenting two separate ambiguities: that of a pronoun and that of coherence. Rather, the choice of a coherence relation *determines* the resolution of a pronoun. Coherence relations, as a matter of their conventionally specified contribution, make

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10 All examples we consider feature relations generally recognized within coherence-theoretic frameworks; see overview and discussion by Kehler (2002: Ch.1) and Jasinskaja & Karagjosova (2020).

a particular referent prominent; the pronoun simply selects the most prominent referent which satisfies its character.

Building on Asher & Lascarides 2003, Stojnić et al. (2017, 2013) posit coherence relations in the logical form of a discourse. The novel contribution is that these relations grammatically encode prominence-affecting updates which set up the context for the interpretation of demonstrative pronouns. They model a context (a conversational record) as a prominence ranking of candidate referents for pronoun resolution. The ranking is dynamically maintained, and evolves with the unfolding discourse.[11] Further, they characterize coherence relations as making a two-fold contribution: a relational contribution, requiring that a particular interpretive connection holds between the relevant bits of discourse, and an update to prominence ranking, making a certain referent prominent, demoting others. For instance, in (11) the possible coherence relations — Result or Parallel — contribute distinct re-ranking updates, making a particular referent the top-ranked one; the subsequent pronoun selects whichever referent has been made the top-ranked one. Thus, the form of (11) is ambiguous — either harboring Result or Parallel; however, the pronoun itself is unambiguous, its interpretation fully specified as a matter of linguistic contribution of the preceding relation, which sets up the local context in which the pronoun is interpreted, making one or the other referent prominent.

Note that on this proposal, general interpretive reasoning can still factor in *disambiguation* of the form of the discourse: in interpreting which form an utterance of (11) exhibits. Nevertheless, a particular disambiguation of the form fully determines the interpretation of a pronoun, because the updates contributed by the elements in the form of the discourse set up the context in which the pronoun is interpreted. For example, if (11) is disambiguated as harboring Parallel, the pronoun is resolved to Stanley; if it is disambiguated as harboring Result, the pronoun resolved to Phil.[12]

For our purposes, it does not matter whether Stojnić et al. (2017) are right about pronoun resolution. In the interest of space, we shall not repeat their arguments. However, we argue that this type of framework is the one we should endorse for 'now': the interpretation of 'now' is sensitive to discourse coherence; contributions of coherence relations fully specify the interpretation of an occurrence of 'now', by contributing prominence-affecting updates, setting the local context for its interpretation.

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11 The account is implemented in a version of dynamic semantics, the ranking represented by an assignment function modeled as a (push down) stack. Utterances are translated as formulae in a formal language, interpreted as dynamic updates: relations between input and output rankings, in the style of relational dynamic semantics. The updates potentially affect the ranking, promoting new referents, demoting others. See the Appendix in Stojnić et al. 2017 for details.

12 For a further discussion of disambiguation vs context-sensitivity resolution, see Stojnić et al. 2017, 2018, 2020.

2.2   Coherence and Temporal Anaphora

We consider a view according to which 'now' selects a prominent time, where the context provides a ranking of reference times. An occurrence of 'now' thus selects the most prominent time within the current ranking.

Both the idea that the context keeps track of prominence of reference times, and that coherence relations affect this prominence, are independently plausible: they are motivated by the considerations concerning the interpretation of tense (Kehler 2002: ch. 7). We see this in (12), where Narration pushes the timeline forward: it makes the time right after that of the event described by the first sentence prominent — focusing on what happened next — and the past tense in the second sentence selects this time: Max spilt the bucket of water right after he slipped.

(12)   Max slipped. He spilt a bucket of water. (Kehler 2002)

Unlike (12), (13) harbors Explanation, which requires the time of the explanans to precede that of the explanandum. That is, Explanation promotes the time just before the speaker hit the male, focusing on what lead to this. Consequently, we get the interpretation that the speaker hit the male because they were first hit by him.

(13)   I hit him because he hit me. (Hunter 2012)

Such effects of coherence on the interpretation of temporal anaphora have been recognized in the literature (Lascarides & Asher 1993). They are naturally modeled within the framework of contextual prominence described in §2.1. We model temporal relations induced by tense anaphorically, by drawing on the Richenbachean distinction between event, utterance, and reference time. We assume that tenses are anaphoric (Partee 1973, Webber 1988), so that a past tense selects a prominent time that precedes the utterance time — the time of the speech event, and locates the eventuality described by the clause within this time.

We characterize the truth-conditional contribution of the past and present tense, respectively, as follows:[13,14]

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13 Here we are just describing the truth-conditional constraints imposed by tense on the interpretation of a tensed clause, inducing a particular temporal relation between reference, utterance and event time. Our ultimate proposal will involve a translation of a fragment of English into a formal language, with a dynamic semantics (see fn. 18 and §5.1–5.6). So, tense will be interpreted as a dynamic update which imposes the relevant truth-conditional constraint in Def. 2.4, and further (re-)centers the ranking of candidate referents for temporal anaphora.

14 We use t and ε as variables for reference times and for eventualities (states and events), respectively. Where ε is an eventuality, $\tau(\varepsilon)$ is its run-time. $\bigcirc$ is the temporal overlap relation, $\prec$ a temporal precedence relation, and $\approx$ the temporal identity relation. We will use s as a variable for an eventuality that is a state. See §5, especially §5.3.

Definition 2.1 (Past Tense).

Given an eventuality ε described by a past tense clause α, past tense requires a reference time t, such that:

- *$t \prec$ utterance time*

- *$t \bigcirc \tau(\varepsilon)$*

The truth-conditional component of the present tense is characterized analogously, with one caveat: we make the standard assumption the present tense in English only happily combines with statives.[15]

Definition 2.2 (Present Tense).

Given a state s described by the present-tense clause α, present tense requires a reference time t, such that:

- *$t \approx$ utterance time*

- *$t \bigcirc \tau(s)$*

While the present tense selects the utterance time as its reference time, the reference time for past tense is determined anaphorically, as the most prominent time in the current state of the conversational record that satisfies the constraint encoded by Def. 2.1, i.e., the most prominent time preceding the speech time. We model prominence by including the prominence ordering of times as potential candidates for temporal anaphora. (Since we are only interested in the temporal domain, we can abstract away from other aspects of the context. So, we can think of the context — the conversational record — as representing a prominence ranking of candidate times — hereafter *reference times* — those higher in the ranking being more prominent.)

An utterance of (14), then, requires that the male hitting the speaker event was during the most prominent time that precedes the utterance time, given the state of the conversational record when it is uttered.

(14)   He hit me.

Further, we want to capture that an utterance can change the state of the record. For instance, an eventive description makes the time right after the event time described available for subsequent anaphora.[16] To model that an utterance can not

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15 We assume that 'John smokes' describes a habitual state and 'John is smoking' a progressive state (Moens & Steedman 1988).

16 Here we follow Partee (1984), although this is inessential. It is compatible with our general account that the eventive description doesn't make the time right after the event time prominent, but that

only receive its interpretation from the context, but also change the context in a way that affects subsequent interpretation, we interpret utterances as dynamic updates, relations between contexts, potentially creating new dependent interpretations for subsequent discourse. Hence, each expression both contributes to the truth-conditional content, and updates the conversational record, affecting the values of contextual parameters that determine the resolution of context-sensitive items.

More precisely, the conversational record includes a prominence ranking of reference times. We assume that the ranking includes an unranked, designated position, Δ, storing the speech time (an analogue of the Kaplanean utterance time parameter), and an unranked position for the eventuality described by an untensed clause, $*$, which serves to extract the eventuality time as needed to compute the truth-conditions.[17] We want to capture that an utterance can introduce an eventuality, temporally locate it with respect to a prominent time in a discourse, and further update the ranking of prominent times in the output context. To model this, we introduce a family of updates, '$\langle\ \rangle$' which introduce an eventuality described by an untensed clause.[18] Where ϕ is a description of an eventuality, representing the

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narrative progression is solely an effect of coherence relations like Narration and Result (Lascarides & Asher 1993). Regardless, we want to model changes in prominence ranking within and between utterances, and dynamic semantic we provide below offers a straightforward way of doing so.

17 Formally, a ranking is an assignment function defined on a finite, convex subset of natural numbers together with unranked elements, Δ and $*$, mapping to the domain of times and eventualities (see §5.4). The assignment is organized by prominence, the item stored at 0 being the top-ranked one. The unranked elements (Δ and $*$) don't affect the ranking. (At present, the updates will be defined so that only times participate in prominence ranking, while eventualities can only be stored at $*$. In §3.2.1, we will change this.)

18 We assume a translation of a fragment of English (minimally including our sample examples) into a formal language that specifies the relevant logical forms. The formal language comprises a set of basic expressions, a set of conditions (atomic formulae closed under negation and conjunction), and a set of update expressions. (For a more precise and complete specification, see §5.1.) The updates described below are a part of this formal language. The formal language in turn shall receive dynamic interpretation. We assume that the natural language fragment contains sentences whose syntax has a TP projection, with a functional T head and a complement phrase. For simplicity, we opt to abstract away from elements of semantic composition not directly relevant for temporal reference, and so assume that the complement translates to an unanalyzed eventuality predicate. That is, for each complement of a TP of a well formed sentence of the relevant fragment, we assume that the logical form in our formal language contains a one place eventuality predicate (represented as $\phi, \psi, \dots$), which can combine with an eventuality variable (e_n for $n \in \mathbb{N} \cup \{*, \Delta\}$) to form a well-formed formula of the language. Eventuality variables of our object language will be interpreted as denoting the eventuality stored at the position of the stack corresponding to its index: so, e_* denotes what's stored at $*$ in the assignment function relative to which it is interpreted. (See §5.1, §5.4 and §5.5 for formal details.) This simplification of the compositional structure is not essential to our account, but the modeling choice allows us to focus on key aspects of our account in a more streamlined way. We thank an anonymous reviewer for inviting this clarification at this point in the paper.

truth-conditional contribution of an untensed clause, the update associated with the untensed clause stores an eventuality satisfying ϕ at the unranked position $*$.[19]

Definition 2.3 (Basic Update).

$\llbracket \langle \phi \rangle \rrbracket (g, g')$ *iff* $g \underset{*}{\sim} g'$ & $\llbracket \phi(e_*) \rrbracket^{g'}$ *where* $g \underset{*}{\sim} g'$ *just in case g and g' differ in at most* $*$*-position, and* e_* *denotes the eventuality stored at* $*$.[20]

This Basic Update provides an eventuality described by the clause, whose temporal location can be further specified by the tense. With this set-up, we can specify the update contributed by past tense. Let ϕ be a description of an eventuality contributed by an untensed clause, and $p(g)$ the most prominent time prior to the utterance time in a ranking g. And let $\blacktriangleright(\tau(\varepsilon))$ be the time right after ε, if ε is an event, and the run-time of ε, if ε is a state.[21] Then, the contribution of past tense is defined as an update that locates the time of the event or state described within the prominent time preceding the utterance time, and makes the time right after that event, or the time of the state, prominent (demoting all others one position in the ranking):

Definition 2.4 (Past). *Where K is an update:*

$\llbracket PAST(K) \rrbracket (g, g')$ *iff* $\exists g''$ *such that* $\llbracket K \rrbracket (g, g'')$ & $p(g) \circ \tau(g''_*)$ & $g'' \underset{0}{\approx} g'$ & $g'_0 = \blacktriangleright(\tau(g''_*))$, *where* $g \underset{n}{\approx} g'$ *iff* $g_i = g'_i$ *for all* $i < n, g'_n$ *is defined, and* $g_i = g'_{i+1}$, *for all* $i \geq n$.[22]

As an illustration, this predicts that the sentence in (14) will select the prominent past time in its input context, locate the event of the speaker being hit at this time, and make the time right after this event prominent. Then, if one follows up with (15), we predict that the speaker hitting back happened right after the event of them being hit described in (14). The past tense in (15) selects the prominent past time in its input context, which is the context outputted by (14); so, this prominent past time is the one right after the event of the speaker being hit. So, (14), followed by (15), is

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19 Where ϕ is a one-place eventuality predicate, and e_* an eventuality variable denoting what's stored at $*$ position of an assignment g, $\llbracket \phi(e_*) \rrbracket^g = 1$ iff $\langle \llbracket e_* \rrbracket^g \rangle \in \mathscr{I}(\phi)$, where $\mathscr{I}$ is the interpretation function of the model. See §5.2 and §5.5 for a more precise specification.

20 More generally, where g and g' are stacks, $g \underset{n}{\sim} g'$ just in case $g_m = g'_m$ for all $m, m \neq n$ (where $m, n \in \mathbb{N} \cup \{*, \Delta\}$).

21 Note that ϕ is a part of our formal language, a one-place eventuality predicate. p, t and $\blacktriangleright$ are operations that belong to the meta-language, describing operations on stacks. See §5.3 and §5.4.

22 The relation $\underset{n}{\approx}$ secures re-ranking: for assignments g and $g', g \underset{n}{\approx} g'$ holds just in case g and g' agree up to n, and all elements in g starting with, and following, n are pushed one position down in g'. So, we achieve a push-down effect. See §5.4 for formal definitions of operations on stacks.

true just in case the speaker was hit by the male during the prominent past time, and they hit him back after they were hit.[23] This is intuitively correct.

(15)   I hit him back.

We also predict that a past tense stative description does not advance the timeline forward. For instance, (16) is predicted to describe two temporally overlapping states, temporally located within the prominent past time in the input context:

(16)   Mary was reading. Bill was sleeping.

Further, we can capture how coherence relations affect the interpretation of temporal anaphora. We represent coherence relations as making a two-fold contribution: they require that a certain relation holds between relevant bits of discourse, and they update the prominence ranking of reference times.[24] For example, where the organizing relation is Explanation, as in (13), the explanans temporally precedes the explanandum. We model this by representing the contribution of Explanation as an update which first updates with the explanandum, and then promotes the time right before the time of the eventuality described by the explanandum, making it prominent once we reach the explanans. More precisely, where K_1, K_2 are updates, and ${}^{\blacktriangleleft}(\tau(\varepsilon))$ the time right before ε if ε is an event, and the run-time of ε if ε is a state:

Definition 2.5 (Explanation)**.**

$[\![EXPLANATION(K_1,K_2)]\!](g,g')$ *iff* $\exists g'', g''', g'''', g''''' s.t. [\![K_1]\!](g,g'')$ & $g''' \underset{0}{\approx} g''$ &

${}^{\blacktriangleleft}(\tau(g''_*)) = g_0'''$ & $[\![K_2]\!](g''', g'''')$ & $g'''' \underset{0}{\approx} g'''''$ & ${}^{\blacktriangleright}(\tau(g''_*)) = g_0'''''$ &

$Explanation(g''_*, g'_*)$[25,26]

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23 We are assuming the standard notion of truth within dynamic semantics, where a formula is true, relative to an input assignment, g, just in case it relates g to a non-empty output assignment, h. See §5.6.

24 Compare Stojnić et al. 2013, 2017, Stojnić 2017, 2019, 2018, Stojnić 2021.

25 Note that $EXPLANATION(K_1,K_2)$ is an update expression (where K_1 and K_2 are updates), and *Explanation* is a relation holding between eventualities e and e', just in case e' explains, or is a cause of e. The provisional characterization of coherence relations between eventualities suffices for our purposes, as the only important aspect is the effect on prominence ranking.

26 Notice that the definition induces another prominence affecting update right after the update with the explanans, which makes the time right after the time of the *explanandum* prominent in the final output context. This is because we want to capture that one naturally can continue a narrative by describing what happened after the explanandum, but not explanans:

(i)   I hit him because he hit me. He then ran away.

To illustrate, we represent (13), where ϕ and ψ are the descriptions of the eventualities contributed by the two sentences, as follows:

(17) $EXPLANATION(PAST(\langle\phi\rangle),PAST(\langle\psi\rangle))$

$EXPLANATION$ first updates the input context with $PAST(\langle\phi\rangle)$, storing the eventuality described by ϕ, the one of the speaker hitting the male, as the value of $*$, and locating it at the prominent past time. Next, it promotes the time right before the explanandum, ϕ, as the new prominent time; this is the re-centering effect of the relation. Further, it updates with $PAST(\langle\psi\rangle)$, introducing a new eventuality, described by ψ — the one of the speaker being hit — and locating it within the prominent past time, which, at this point, is the time right before the eventuality described by ϕ. Finally, it is required that the explanans event, ψ, explains the explanandum one, ϕ. This correctly predicts that the discourse is true just in case the speaker hit the male at a prominent time in the past, because they were hit by the male right before that.

Similarly, Narration contributes a prominence-affecting update:

Definition 2.6 (Narration). *Where K_1 and K_2 are updates:*

$[\![NARRATION(K_1,K_2)]\!](g,g') \text{ iff } \exists g'',g''' s.t. [\![K_1]\!](g,g'') \ \& \ g''' \approx_0 g'' \ \& \ ^\blacktriangleright(\tau(g''_*)) = g'''_0 \ \& \ [\![K_2]\!](g''',g') \ \& \ Narration(g''_*,g'_*).$[27]

Accordingly, (12) is represented as (18), where ϕ and ψ are the descriptions of the eventualities contributed by the two sentences:

In (i), the male is understood to have ran away after being hit by the speaker, which happened after he hit the speaker. This results from Narration connecting the two sentences in (i). This is compatible with Narration sometimes "scoping under" Explanation:

(ii)   I hit him because he hit me and called me liar.

Here the complement of the *because*-clause connects to the main clause via Explanation, and the two conjuncts embedded in the *because*-clause are connected via Narration. Given Def. 2.4 of past tense, Def. 2.5 of Explanation, and Def. 2.6 of Narration, and letting ϕ, ψ and γ be descriptions of eventualities, we would represent (i) and (ii) respectively as follows:

(iii) $NARRATION((EXPLANATION(PAST(\langle\phi\rangle),PAST(\langle\psi\rangle))),PAST(\langle\gamma\rangle))$

(iv) $EXPLANATION(PAST(\langle\phi\rangle),NARRATION(PAST(\langle\psi\rangle),PAST(\langle\gamma\rangle)))$

We thank an anonymous reviewer for inviting clarification regarding the prominence affecting contribution of Explanation in its final output context.

27 We provisionally characterize *Narration* as holding between eventualities e and e' just in case e' continues a narrative with respect to e; i.e., the time of the onset of e' is the time of the consequent state of e. Again, not much hangs on this characterization; what matters for us is the effect on prominence.

(18) $NARRATION(PAST(\langle \phi \rangle), PAST(\langle \psi \rangle))$

(18) first updates the input context with $PAST(\langle \phi \rangle)$, storing the eventuality described by ϕ, the one of Max slipping, as the value of $*$, locating it at the prominent past time, and making the time right after it prominent. Next the update contributed by Narration re-promotes that very same time.[28] Further, it updates with $PAST(\langle \psi \rangle)$, introducing a new eventuality, described by ψ (i.e., spilling) and locating it within the prominent past time, which, at this point, is the time right after the eventuality described by ϕ (i.e., slipping). Finally, it requires that the eventuality described by ψ continues the narrative initiated by the one described by ϕ. So we derive the correct truth-conditions: the discourse is true just in case Max slipped and *then* spilt a bucket of water.

Unsurprisingly, Result has a similar effect on temporal interpretation as Narration:

(19)   Max kicked him, so he fell.

The update will be analogous, with the only difference in the relational contribution — Result requires the first eventuality causes the second:

Definition 2.7 (Result). *Where K_1 and K_2 are updates:*

$[\![RESULT(K_1, K_2)]\!](g, g')$ *iff* $\exists g'', g''' s.t. [\![K_1]\!](g, g'')$ & $g''' \approx_0 g''$ & $^{\blacktriangleright}(\tau(g''_*)) = g'''_0$ & $[\![K_2]\!](g''', g')$ & $Result(g''_*, g'_*)$[29]

The discourse in (19) is thus represented and interpreted analogously to that in (12).

Finally, consider (20-a) and (20-b), where the two eventualities are understood as simultaneous.

(20)   a.   Mary entered the room. It was dark.
        b.   Max spilt a bucket of water. He spilt it all over the rug.

Again we can appeal to coherence effects to explain this interpretation. In (20-a) the discourse is organized around Background: the second sentence describes the background circumstances under which the eventuality described by the first occurred. Background makes prominent the time of the "figure," the eventuality the

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28 So, in this case, assuming (as we have done) that eventive descriptions make the time right after the event prominent, the update contributed by Narration just pushes the copy of that same time on the top of the stack, rendering the effect of the update redundant. If we thought that eventives did not push the timeline forward on their own, then the update would be substantive. The choice between the two views is inessential for our purposes.

29 We assume provisionally that *Result* holds between eventualities e and e' just in case e' is caused by, or is explained by e.

background circumstances (the "ground") of which are being described — here, entering the room. The past tense in the second sentence selects this time, and requires that the eventuality it describes — that of the room being dark — temporally overlap this time. This captures the temporal overlap interpretation. Similarly, in (20-b), the discourse is organized by Elaboration; as a result, the time of the event elaborated on — that of Max spilling the water — is promoted, and (given the contribution of the past tense) the event described by the second sentence is required to temporally overlap this event.

To model this, we define updates for Background and Elaboration which induce this temporal-overlap effect:

Definition 2.8 (Background). *Where K_1 and K_2 are updates:*
$\llbracket BACKGROUND(K_1, K_2) \rrbracket (g, g')$ *iff* $\exists g'', g''' s.t. \llbracket K_1 \rrbracket (g, g'')$ & $g''' \underset{0}{\approx} g''$ & $\tau(g''_*) = g'''_0$ & $\llbracket K_2 \rrbracket (g''', g')$ & $Background(g''_*, g'_*)$[30]

Definition 2.9 (Elaboration). *Where K_1 and K_2 are updates:*
$\llbracket ELAB(K_1, K_2) \rrbracket (g, g')$ *iff* $\exists g'', g''' s.t. \llbracket K_1 \rrbracket (g, g'')$ & $g''' \underset{0}{\approx} g''$ & $\tau(g''_*) = g'''_0$ & $\llbracket K_2 \rrbracket (g''', g')$ & $Elaboration(g''_*, g'_*)$[31]

Thus, we successfully capture temporal relations, including shifts in narrative progression induced by coherence relations. Temporal anaphora is resolved as a function of the current state of context, selecting the top-ranked reference time that satisfies the constraints imposed by tense. So, given our account of prominence, tense behaves like a pure indexical.[32]

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30 We characterize *Background* as holding between eventualities e and e' just in case e' is a ground for the figure e, i.e., it describes background circumstances against which e occurs.

31 We characterize *Elaboration* as holding between eventualities e and e' just in case e' is a part of, and provides further information about, e.

32 One might worry that, since the prominence-affecting updates invoke temporal relations of being "right after/before" an event, this undercuts the idea that past tense (and by extension, 'now') is a pure indexical. The worry is that these relations are vague and underspecified, allowing for temporal gaps of varying degrees between their relata. In response, we first note that some vagueness or underspecification was already inherent in the original pure indexical view — while 'now' on that view selects the utterance time, this is understood to allow for a time interval of varying degrees, temporally surrounding or overlapping the utterance time. More importantly, our official account, which we'll defend in §3.2, is that 'now' selects the consequent state of a prominent event. Correspondingly, "the time right after/before" an eventuality will be understood as the time of the onset and consequent state of the eventuality, respectively. While there might be vagueness regarding the duration of onsets and consequent states, this is no more threatening to the pure indexical view then the vagueness of what counts as a location or time of utterance to the traditional pure indexical account of 'here' and 'now' (or indeed, than is the vagueness of what counts as the speaker or addressee threatening for the pure indexical accounts of 'I' or 'you.') We don't have to settle the metaphysics of onsets and

With this setup in mind, we turn to 'now.' The interpretation of 'now,' we argue, is sensitive to the effects of coherence in a similar way tense is. So, it is natural to characterize the meaning of 'now' as selecting a prominent time, where prominence is maintained through contribution of coherence. We outline this type of account in §3.1. We show that, while it has many advantages, it falls short of a fully satisfactory analysis, failing to explain the contrast between (13) and (7). This challenge leads us to pursue an alternative account in §3.2, according to which 'now' selects not a prominent time, but rather, a prominent state.

3 What is the content of 'now'?

3.1 Time-prominence account

The idea that 'now' selects a prominent time is a natural extension of the traditional idea that it selects *the utterance time*. Indeed, such an extension has often been pursued in the last forty years, starting with the descriptive generalizations by Dry (1979) and, independently, the formal proposals by Hans Kamp and colleagues (Kamp & Rohrer 1983, Kamp & Reyle 1993).[33] We have already seen that coherence affects the prominence ranking of candidate times. So, if 'now' is anaphoric to times, then given the account of tense in §2, we already have all the ingredients needed to capture the prominence-sensitivity of 'now.'

But what constraints (if any) does 'now' place on the prominent time it selects? We propose to consider the view that 'now' selects the most prominent time in its input context and requires that it overlaps the time of the onset of the eventuality described by the clause containing it. Formally:

Definition 3.1 (Now, first pass). *Where K is an update, and @T denotes the top-ranked time:*[34]

$[\![NOW(K)]\!](g,g')$ *iff* $[\![K]\!](g,g')$ $\&$ $\tau(^{\triangleleft}(g'_*)) \bigcirc [\![@T]\!]^g$,
where for an eventuality u, $^{\triangleleft}(u)$ is the onset of ε, if ε is an event, and $^{\triangleleft}(\varepsilon) = \varepsilon$ otherwise.[35]

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consequent states before we can appeal to them in the semantics. Thanks to Josh Dever for pressing this point.

33 See also Altshuler 2009, Lee & Choi 2009, Altshuler 2010, Hunter 2010, Lee 2010, Hunter 2012, Altshuler & Stojnić 2015, Altshuler 2016, Lee 2017, Carter & Altshuler 2017, Anand & Toosarvandani 2019, Altshuler 2020, Altshuler & Michaelis 2020.

34 More precisely, @ takes a unary predicate and delivers the top-ranked value that satisfies the predicate (if any). T is a unary predicate, satisfied by an entity just in case it is a time. So, @T performs a search down the stack until it finds a time. See §5.1 and §5.5.

35 With this in place we can assume that "the time right before" is the time of the onset: $\tau(^{\triangleleft}(\varepsilon)) := \,^{\blacktriangleleft}(\tau(\varepsilon))$.

Notice that $^\triangleleft(\varepsilon) = \varepsilon$ if ε is a state. We assume that the onset of a state is simply that state (Altshuler & Schwarzschild 2012, 2013), whereas the onset of an event is the preparatory action (or pre-state) of that event (Moens & Steedman 1988). The intuitive justification comes from a homogeneity intuition: states are homogeneous in ways events are not (Bennett & Partee 2004). E.g., if Ann was happy for five minutes, the state of her being happy held throughout that interval.[36] This assumption will become important in capturing that stative descriptions (including 'now'-modified ones) don't advance the timeline forward, except (as we shall see) when they attach to the prior discourse via Result. The assumption isn't strictly required for our analysis of 'now': we could allow that states have onsets but that the operator $^\triangleleft$ operates differently on states and events, delivering the onset of an event if the input is an event, and returning the input state, if the input is a state. While one of these assumptions is required to yield the desired predictions concerning stative descriptions, either one would suffice, and our analysis would proceed in the same way regardless of the choice. In what follows, we pursue the first option and assume that states don't have onsets.

Def. 3.1, coupled with the account of tense in §2, allows us to analyze some of the examples in §1, which we consider in turn, beginning with (3), simplified as (21-a). We represent it as (21-b) (where ϕ and ψ are descriptions of the eventualities described by the two sentences in (21-a)):

(21) a. Budha Bapp laid down in the clearing. The tigress now got up.
      b. $NARRATION(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$[37]

The first sentence describes the event of the tiger emerging and laying down by the tigress; the past tense requires this event to overlap the most prominent time preceding the utterance. Moreover, the past tense promotes the time just after Budha Bapp laying down. The second sentence relates to the first via Narration, which (given Def. 2.6) replicates the past tense update, re-promoting the time just after Budha Bapp laying down.[38] Finally, 'now' selects this time, and requires that the onset of the tigress getting up temporally overlap it. This correctly predicts that the tigress got up, right after the tiger laid down.

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36 The assumption that states have no onsets (or consequent states) was already implicit in our definition of $^\triangleleft$ and $^\triangleright$.

37 We assume the update with 'now' precedes that with tense, but this is inessential: the two possible orders of updates yield equivalent predictions in our framework. As we are neglecting the compositional structure below the clause-level which would reflect possible positioning of 'now' within a clause, the order of updates is a matter of convention.

38 Recall, coherence relations do not always replicate the effects of tense.

Now consider (4), simplified as (22-a). We represent it as (22-b) (where ϕ is the description of the event described by the first, and ψ the description of the state described by the second, sentence in (22-a)):

(22) a. One after another, they flew out. The room was empty now.
      b. $RESULT(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

There are two notable differences between this discourse and (3). First, the last two sentences of (4) are connected by Result, rather than Narration. Since Result — like Narration — pushes the timeline forward, the interpretation of 'now' will proceed analogously: Result promotes the time "right after" the eventuality describing the cause, and 'now' selects it. The second difference is that the complement of 'now' is stative in (4). Given Def. 3.1, the onset of the state of the of the room being empty just is that state. So, 'now' requires that this state temporally overlap the reference time: the time just after the two birds flew out. Further, it is required that the emptiness was caused by them flying out. This correctly predicts the room was empty right after the two birds flew out.

In turn, we represent (9) — which has a temporally overlapping interpretation — as (23):

(9) The janitor turned off the lights. The room was empty now.

(23) $BACKGROUND(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

The first sentence describes the event of the janitor turning off the lights; past tense requires that it overlaps the most prominent time preceding the utterance. Further, past tense promotes the time right after the janitor turning off the lights. But the second sentence relates to the first via Background, which (as per Def. 2.8) makes the time of the figure (i.e. the turning off event) prominent. That is, Background (like Explanation) moves the timeline backwards; it contributes a re-centering update, promoting the time of the janitor turning off the lights, demoting the time initially made prominent by the tense (the time right after this event). 'Now' selects the currently prominent time — the time of the janitor turning off the light. The onset of the state of the room being empty — which, again, is just that state — is required to temporally overlap the reference time: the time the janitor turned off the lights. This correctly predicts that the room was empty when the janitor turned off the lights.

Taking stock, the account can handle a range of discourse-bound uses of 'now,' involving temporal progression and temporal overlap. Further, it can also capture discourse initial uses of 'now', assuming that the most prominent time in such cases is just the utterance time. On this view, 'now' in (24) selects the utterance time and requires the state of the speaker being happy to overlap it.

(24)   I am happy now.

Unfortunately the time-prominence account faces some non-trivial challenges. Here, we note the most serious one.[39] Recall (13) and (7):

(13)   I hit him because he hit me.

(7)   #I hit him because he now hit me.

We explained how the account predicts the intuitively correct interpretation of (13) in §2. However, it cannot explain its contrast with (7), which is represented as (25) (where ϕ is a description of the eventuality described by the first sentence, and ψ that by the second):

(25) $EXPLANATION(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

Given (25), (7) receives exactly the same truth-conditions as (13). As in (17), (25) first updates an input context with $PAST(\langle\phi\rangle)$, locating the eventuality of the speaker hitting the male within the prominent past time. Second, it promotes the time right before this event. Finally, it updates with $NOW(PAST(\langle\psi\rangle))$. This update searches for the most prominent time in its input context — the time right before the speaker hitting the male — and requires that the eventuality described overlaps this time, and its onset be located within it. But this gives exactly the interpretation we got in (13). Yet, this is not a possible reading of (7).

Hunter (2012) attempts to accommodate this datum in a way that's friendly to the time-prominence account, offering the following rule that constrains when 'now' *can* select a particular antecedent:

Definition 3.2 (Hunter's 'Now' Constraint). *Given a pair of discourse units, π_1 and π_2, if 'now' is in π_2 and selects a reference time in π_1, then (a) and (b) hold:*

(a) *π_2 is subordinate to π_1.*

(b) *The eventualities described by π_1 and π_2 overlap in time.[40]*

This rule involves several technical terms from Segmented Discourse Representation Theory (SDRT) (Asher & Lascarides 2003): first, a *discourse unit*, which you can think of as an eventuality description; and second, a distinction between *coordinating* and *subordinating* coherence relations, where the former change the scene, while the

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39 Compare Altshuler & Stojnić 2015, Altshuler 2016.
40 Hunter's constraint is actually more flexible, allowing the eventualities described by π_1 and π_2 to either overlap or abut. This additional flexibility is not relevant to the data we consider.

latter detail the scene.[41] The relations we discussed so far in this paper are divided along this dimension as follows in SDRT:

- **Subordinating relations**:
  Background, Elaboration, Explanation, …

- **Coordinating relations**:
  Result, Narration, Parallel, …

With this setup, Hunter can explain why 'now' can occur in (5) but not in (7), even though both feature a subordinating relation, Explanation. Hunter notes that in (7), (b) of Def. 3.2 is not satisfied: "the cause ended before the effect began, so *now* is not licensed (ibid)." (5) differs from (7) because the cause (π_3) immediately brought its effect (π_2) and the time of the eventuality in π_2 overlaps the time of the eventuality in π_3.

Unfortunately, however, Hunter's rule cannot be the correct generalization. Given a pair of discourse units, π_1 and π_2, 'now' *can* occur in π_2 and select a prominent event in π_1 when the following coordinating relations hold: Result(π_1, π_2), as in (4); Narration(π_1, π_2), as in (3); Parallel(π_1, π_2), as in (26) below:

(26)   a.   [Phil tickled Stanley]π_1
        b.   [And now Liz did too.]π_2

This undermines Hunter's proposal that 'now' is sensitive to discourse structural properties of coherence relations reflected in Def. 3.2. By contrast, we maintain that 'now' can occur in a clause following any coherence relation, be it subordinating or coordinating. But because coherence relations have effects on prominence that force a particular interpretation of 'now', sometimes the interpretation thus fixed can be incoherent or inconsistent, leading to infelicity.

To our knowledge Hunter's is the only time-prominence account attempting to capture the contrast in (13)–(7). Another way we could try to explain it, while maintaining that 'now' selects a time, is to say it selects a very particular time: the time of the consequent state of a prominent event. This is nearly identical to our positive account in the next sub-section. The lone difference is that rather than picking out *the time* of the consequent state of a prominent event, we will pursue the hypothesis that 'now' selects *the consequent state* of a prominent event. That is, we will pursue the view that the content of 'now' is a state (not a time): the consequent state of a prominent event. But, even if we wanted to maintain that 'now'

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41 See Asher & Vieu (2005), Jasinskaja & Karagjosova (2020) for discussion of this distinction, including empirical motivations and ways of defining these notions. The rough description suffices for our purposes.

selects the time of the consequent state of a prominent event, we would still need the mechanisms introduced in the next section for keeping track of prominence of eventualities, so that 'now' can locate a prominent event, and select the time of its consequent state. In other words, 'now' would still, in an important sense, be anaphoric to consequent states of prominent events, and much of what we argue below would remain unchanged.

3.2 Event-prominence account

We now turn to our positive account. In §3.2.1 we extend the formal framework introduced in §3.1 and show how it accounts for all the examples discussed thus far. Then, in §3.2.2, we show how the account also handles a wide-range of discourse-initial uses of 'now'.

3.2.1 Discourse-bound, past-tensed uses

We propose, following Altshuler & Stojnić (2015) that 'now' selects the *consequent state* of a prominent event. Further, we maintain that, in addition to affecting the prominence of reference *times*, coherence relations also affect the prominence of eventualities. We implement this formally by extending the system we presented in §2.[42] As before, we let the context represent a ranking of prominent times. In addition, we include eventualities (events and states) in the ranking. We still assume an unranked position $*$ for the eventuality described by an untensed clause, and Δ, for the speech time; further, we include an unranked position for the speech event, υ.[43]

The basic update still introduces an eventuality. The only difference is that it also makes this eventuality prominent in the output context. So, instead of Def. 2.3, we adopt:

Definition 3.3 (Basic Update).

$$\llbracket \langle \phi \rangle \rrbracket (g, g') \text{ iff } \exists g'' \text{ such that } g \underset{*}{\sim} g'' \ \& \ \llbracket \phi(e_*) \rrbracket^{g''} \ \& \ g'' \underset{0}{\approx} g' \ \& \ g'_0 = g''_*$$

The contribution of tense remains the same (see Def. 2.4). 'Now', however, gets a different interpretation. It searches for the prominent event, and requires the onset of the eventuality described by the clause containing it overlaps the *consequent state of*

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42 We offer key elements of our analyses here, and we reserve detailed exposition and derivations of the key examples for §5.

43 The ranking is now an assignment function, defined on a finite, convex subset of natural numbers together with the unranked elements, Δ, υ and $*$, mapping to the domain of times and eventualities (events and states). We represent the relative ranking of eventualities, and that of times, via a single assignment; see §5.4. This choice is made for simplicity, and is inessential to our main point.

that event. So, instead of Def. 3.1, we adopt Def. 3.4, where $^{\triangleright}(\varepsilon)$ is the consequent state of the event ε.[44]

Definition 3.4 (Now)**.** *Where K is an update:*

$[\![NOW(K)]\!](g,g')$ *iff* $[\![K]\!](g,g')$ & $\tau(^{\triangleleft}(g'_*))$ $\bigcirc$ $^{\triangleright}([\![@EV]\!]^g)$*, where* $[\![@EV]\!]^g$ *is the top-ranked event in g.*[45]

We still want to capture coherence effects on contextual prominence; we still maintain coherence relations affect prominence of reference times. But now we also allow that they affect prominence of eventualities. Accordingly, we modify our definitions of the updates associated with coherence relations (Defs. 2.5-2.9) as follows (where K_1 and K_2 are updates):

Definition 3.5 (Narration)**.**

$[\![NARRATION(K_1,K_2)]\!](g,g')$ *iff* $\exists g'',g''',g''''s.t.[\![K_1]\!](g,g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(^{\triangleright}(g'''_0))$ & $[\![K_2]\!](g''',g')$ & *Narration*(g''_*,g'_*)

Definition 3.6 (Result)**.**

$[\![RESULT(K_1,K_2)]\!](g,g')$ *iff* $\exists g'',g''',g''''s.t.[\![K_1]\!](g,g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(^{\triangleright}(g'''_0))$ & $[\![K_2]\!](g''',g')$ & *Result*(g''_*,g'_*)

Definition 3.7 (Background)**.**

$[\![BACKGROUND(K_1,K_2)]\!](g,g')$ *iff* $\exists g'',g''',g''''s.t.[\![K_1]\!](g,g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(g'''_0)$ & $[\![K_2]\!](g''',g')$ & *Background*(g''_*,g'_*)

Definition 3.8 (Elaboration)**.**

$[\![ELABORATION(K_1,K_2)]\!](g,g')$ *iff* $\exists g'',g''',g''''s.t.[\![K_1]\!](g,g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(g'''_0)$ & $[\![K_2]\!](g''',g')$ & *Elaboration*(g''_*,g'_*)

Definition 3.9 (Explanation)**.**

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44 Analogous to the assumption that only events have onsets, we assume that only events have consequent states. So, where ε is a state, we will assume that $^{\triangleright}(\varepsilon) = \varepsilon$. The intuitive justification is the same as in the case of onsets. And as before, we could alternatively assume $^{\triangleright}$ just operates differently on states and events. We also assume that the "time right after" is the time of the consequent state: $\tau(^{\triangleright}(\varepsilon)) := ^{\blacktriangleright}(\tau(\varepsilon))$.

45 *EV* is a unary predicate, satisfied by an entity just in case it is an event. @*EV* performs a search down the stack until it finds an event (if any). See §5.1 and §5.5.

$\llbracket EXPLANATION(K_1,K_2) \rrbracket(g,g')$ iff $\exists g'',g''',g'''',g''''',g'''''' s.t. \llbracket K_1 \rrbracket(g,g'')$ & $g''' \approx_0$

g'' & $^\triangleleft(g''_*) = g'''_0$ & $g'''' \approx_0 g'''$ & $g''''_0 = \tau(g'''_0)$ & $\llbracket K_2 \rrbracket(g'''',g''''')$ & $g''''' \approx_0 g'''''$ &

$^\triangleright(g''_*) = g''''''_0$ & $g'''''' \approx_0 g'$ & $g'_0 = \tau(g''''''_0)$ & $Explanation(g''_*,g'_*)$

The updates are exactly the same as before, except that they now induce additional effects on the prominence of eventualities. We describe these effects by working through the examples from the previous section, starting with (21-a), repeated here:

(27)   a.   Budha Bapp lay down in the clearing. The tigress now got up.
       b. $NARRATION(PAST(\langle\phi\rangle),NOW(PAST(\langle\psi\rangle)))$[46]

Given Defs. 2.4, 3.3 and 3.5, (27-b) first updates the context with $PAST(\langle\phi\rangle)$, introducing and making prominent the event of Budha Bapp laying down, and the time of its consequent state ("the time right after"). Next, it induces the Narration's event- and time-prominence re-ranking effect, which just re-promotes the already most prominent event (and the time of its consequent state). Finally, it updates with $NOW(PAST(\langle\psi\rangle))$, which selects the top-ranked event, locates the onset of the eventuality described by ψ (i.e. getting up), in the consequent state of this event, and requires that it temporally overlap the most-prominent time (which is still the time right after the laying down). Finally, the event of the tigress getting up, and the time right after it are promoted in the output context and it is required that Narration hold between this event and the event of Budha Bapp laying down. This correctly predicts that the tigress got up after Budha Bapp laying down.

Since the update associated with Result has the same effect on prominence of times and eventualities as Narration, the interpretation of (22-a), repeated in (28), is similar. However, the second sentence is a stative description, so ψ in (28-b) is a description of a state, and its onset is just that state. The update with $NOW(PAST(\langle\psi\rangle))$ requires that this state temporally overlap the consequent state of the prominent event, and the prominent time (right after the birds flew out). Finally, it is required that the state of the room being empty be a result of the event of flying out: the room was empty after, and as a result of the birds flying out.

(28)   a.   One after another, they flew out. The room was empty now.
       b. $RESULT(PAST(\langle\phi\rangle),NOW(PAST(\langle\psi\rangle)))$

We also get the desired prediction in (9), repeated as (29-a): the two eventualities temporally overlap. (29-b) first updates with $PAST(\langle\phi\rangle)$, which proceeds exactly

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46 As before, we assume that the update with 'now' precedes that with tense. As before, the two possible orders of the updates yield equivalent predictions in our framework.

as in the previous two cases. Next, as per Def. 3.7, the ground-event (turning off the lights) described by the first sentence and its time are made prominent. $NOW(PAST(\langle\psi\rangle))$ selects this event, and requires that the state it describes overlap both its consequent state and the prominent time, i.e. the time of the ground-event. This guarantees that we get temporal overlap: the turning off is simultaneous with the room being empty.

(29)   a.   The janitor turned off the lights. The room was empty now.
        b. $BACKGROUND(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

Let us now reconsider (13), which has the representation in (30) (where ϕ describes the eventuality of the speaker hitting the male, and ψ the one of the speaker being hit by him):

(13)   I hit him because he hit me.

(30) $EXPLANATION(PAST(\langle\phi\rangle), PAST(\langle\psi\rangle))$

(30) first updates with $PAST(\langle\phi\rangle)$, introducing an event of the speaker hitting the male, locating it at the prominent past time in the input context (and, given past tense, promoting the time right after it). Next, per Def. 3.9, the onset of this event (the speaker being hit), and the onset's time, are promoted, leading to an intermediate context. Finally, we update with $PAST(\langle\psi\rangle)$, which introduces the event described by ψ (the speaker being hit), and locates it at the most prominent past time. At this point, this is the time of the onset of the first event, described by ϕ. This yields the interpretation that the speaker hit the male, after he hit the speaker. Finally, the consequent state of the explanandum event and its time are promoted in the final output context, and it is required that the explanandum (ϕ) and the explanans (ψ) are related via Explanation. So, we preserve the intuitively correct prediction.

But now, finally, we can also explain the contrast between (13) and (7), which has the representation in (31):

(7)   #I hit him because he now hit me.

(31) $EXPLANATION(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

Like (30), (31) begins with an update of the initial context with $PAST(\langle\phi\rangle)$: introducing the event of the speaker hitting the male, locating it at a prominent past time in the input context, and promoting the time right after it. Further, as in (30), Explanation promotes the onset of this event, and the onset's time, leading to an intermediate context. However, unlike in (30), now we update this intermediate context with $NOW(PAST(\langle\psi\rangle))$. This update first introduces the eventuality described by ψ — the speaker being hit — and locates it at the most prominent past time in the

current input context, i.e., the time of the onset of ϕ. Moreover, it searches for the most prominent event in the current input context, which is the event that was most recently promoted, ϕ — the speaker hitting — and requires that the onset of ψ, the event of the speaker being hit, temporally overlap the consequent state of this event. But this leads to a contradiction — the event of the speaker being hit is required to, at the same time, temporally overlap the onset of the speaker hitting, and have its onset be within the consequent state of the speaker hitting. No eventuality can satisfy this requirement. Hence the infelicity.[47]

So we successfully capture the contrast between (13) and (7). But our system does not predict that 'now' can never occur in the explanans relatum of Explanation. Here's an example we mentioned earlier:

(5)   He stopped talking to his old friends because he was now a big shot politician who didn't want to mix with the *hoi polloi*.

In (5), 'now' occurs in a stative description. As before 'now' selects the prominent event, which given the import of Explanation (as per Def. 3.9) is the event of ceasing to talk. It requires that the onset of the eventuality described by its complement overlap the consequent state of this event and (given the import of past tense) the prominent past time, which by Def. 3.9, is the time of the onset of the stopping event. But given that the onset of a state just is this state, this boils down to the requirement that the state of being a big shot politician overlaps the consequent state of ceasing to talk, and also the time right before it (i.e., its onset). This is intuitively right: the prominent male being a big shot politician held both before and after he stopped talking to his friends, and it explains why he stopped talking.

Note, while 'now' requires that the state of being a big shot *overlaps* the consequent state of ceasing to talk, we don't require or predict that it *results* from or *follows* the event of ceasing to talk. Since Explanation requires that being a big shot also overlaps the onset of ceasing to talk, it will wrap around this event and span into the past. It is thus compatible with our analysis that it could result from or follow some further prior event, e.g.:

(32)   John won the election. He stopped talking to his old friends because he was now a big shot politician who didn't want to mix with the *hoi polloi*.[48]

Taking stock, given that 'now' is sensitive to prominence of events, we capture its various discourse-bound uses. As shown by the examples like (13) and (7), the import of coherence is crucial: only once we recognize the effect of Explanation can we explain their contrast. Moreover, the effect of coherence appears to be

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47 Derivations for (30) and (31) are in §5.7.
48 Thanks to Malte Willer (p.c.) and an anonymous reviewer for discussion.

conventionalized, not a byproduct of pragmatic reasoning: one cannot make (7) felicitous by accommodating some prominent event; and even when an event *is* made available, (7) remains infelicitous:

(33)   First, Bill insulted me. #I hit him because he now hit me.

This would be surprising if the import of coherence on prominence were merely a pragmatic default, as plausibility considerations would favor the alternative interpretation whereby 'now' selects the consequent state of Bill's insulting, as would charity and relevance. That both (7) and (33) only have the infelicitous interpretation tells rather strongly in favor of the account that traces the shift in prominence to the grammatical import of coherence.[49]

Additional support for our account comes from its ability to explain the "change of state" inference triggered by many (though not all) occurrences of 'now' (Recanati 2004). For instance, in (4), we understand that the room wasn't empty before Faith and Hope flew out. This is because 'now' requires that the (onset of) the room being empty overlap the consequent state of the prominent event — the birds flying out — and *further*, due to Result, that it be caused by this event. So, (assuming effects cannot pre-date their causes), we get the "change of state" inference. However, the change of state need not always be relative to the immediately most prominent event: in (9), we again understand that the room was empty during the consequent state of the prominent event — turning off the lights. But we don't interpret (9) as saying that the room *wasn't* empty during or immediately before the turning off of the lights, as the discourse features Background, not Result. This, is compatible with there being some further event in the discourse, with respect to which such change is inferred, e.g.:[50]

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49 An anonymous reviewer provides the discourse in (i) below, which is felicitous for some speakers. For others, a pluperfect is preferred, i.e., 'I hit him (finally) because he had now worked up the courage to hit me'. This suggests that those speakers who accept (i) also allow the pluperfect and the simple past to alternate — a well attested phenomenon (as the pluperfect is slowly disappearing in English). If this is right, then the felicity of (i) is not surprising. Assuming that the perfect is a stativizer (Moens & Steedman 1988, Kamp & Reyle 1993), (i) would receive an analysis on a par with (5). We note that (33) and the original (7) cannot be interpreted in this way because there is nothing in the context that supports aspectual coercion, and so the use of the pluperfect, which is known to require a proper set-up (Reichenbach 1947: §51), would result in oddity.

(i)   He had hit each of my friends on various occasions, and I did nothing. I hit him (finally) because he now worked up the courage to hit me.

50 Even when there is no explicitly mentioned event that triggers a change of state one can typically infer that one had occurred. But since on our account 'now' merely requires a prominent event, not necessarily a prominent event that prompted a change of state, the interpretation of 'now' does not semantically require that such an event be accommodated. Note also that we always get the "change

(34)   The janitor turned off the lights. The room was empty now, because the students left earlier.

We conclude this subsection by discussing one class of examples like (35) (due to Josh Dever, p.c.), which licenses 'now' even though it does not provide an event to serve as its antecedent:

(35)   It was nearly midnight. Gregor was now exhausted and ready for sleep.

While (35) is not infelicitous, it does, however, appear incomplete. The impression is we were thrown in the middle of a story wondering 'When was it midnight? What happened then?' Indeed, the first sentence remains incomplete even without 'now,' if it's the sole thing asserted out of the blue, or followed only by a description of some state that held during that time:

(36)   a.   It was nearly midnight.
         b.   It was nearly midnight. It was raining.

This suggests that there is an implied event in (36) which the two sentences further elaborate on.[51] Such an event could be provided if (36) is embedded in a discourse:

(37)   I arrived home. It was nearly midnight. Gregor was now exhausted and ready to sleep.

Here, the second two sentences elaborate on the event described by the first. Elaboration between the first two sentences makes the arrival event and time prominent and the past tense requires that the state of being nearly midnight overlaps it. The third sentence further elaborates on the second, and the eventuality elaborated on (being nearly midnight), and its time are promoted. The past tense requires that Gregor being exhausted overlaps this time. Finally, 'now' selects the consequent state of the prominent event (the event of arrival) and requires the state of Gregor being exhausted overlaps this time. So, we correctly predict that Gregor was exhausted when the speaker arrived home, and it was nearly midnight then.[52]

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of state" inference when the clause featuring 'now' is a description of an event, since it will be required that the event's onset was during the consequent state of the prominent event, the antecedent for 'now.'

51 As an anonymous reviewer points out, (36) can be interpreted as setting a stage for an event (e.g., to draw the reader directly into the situation described), whereas with 'now' we expect some *implicit* event that the stative descriptions elaborate on; this further bolsters our point that 'now' searches for a consequent state of an event.

52 Similarly, temporal adverbs can constrain the interpretation of discourses containing 'now:'

(i)   John took a pill after dinner. In the morning, he was now feeling great.

But (36-a) is exceptional in that constructions which merely provide a reference time, but not an event, do not *in general* license 'now,' as illustrated by the following:[53]

(38)   #I like to think back on the summer of '97. I was so happy now. (Hunter 2012: 1)

We thus conclude that 'now' can be licensed in a follow up to (35), either if the discourse is embedded in a larger one that provides the relevant eventuality, or if it is understood as elaborating upon some eventuality that is presumed to be available in the context the audience is not privy to, such as in the opening of a story.[54]

3.2.2   Discourse-initial uses

If 'now' selects the consequent state of a prominent event, which event is prominent discourse initially? Note, an utterance containing 'now' can be used to comment on an event the interlocutors just observed:

(39)   [Upon being kicked in the shin:] Ouch, my leg hurts now!

Intuitively, in (39) the event of kicking is prominent, and 'now' requires that the state of feeling pain overlaps the consequent state of this eventuality (and due to present tense that it also holds at the utterance time). But what makes this eventuality prominent? And if different events can be prominent in an utterance situation, how is this in line with our claim that 'now' is a prominence-sensitive pure indexical?

We maintain that an utterance discourse initially can comment on an eventuality if it stands in a suitable coherence relation to that eventuality. The relation makes the eventuality prominent in the input context, and 'now' selects it as its antecedent. The idea that 'now' can pick up the consequent state of an event in the speech situation

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Since (i) is organized by Result, taking a pill event, and the time right after it, are promoted; 'now' selects the consequent state of this event and requires that it overlaps the (onset of) John feeling great. Further, we assume that adverbs like 'In the morning,' locate the described eventuality at the closest morning after the reference time (Kamp & Reyle 1993: Ch.5), which – given the tense – is prior to the speech time. This is intuitively correct: as a result of taking a pill after dinner, John was feeling great the following morning. We thank Josh Dever (p.c.) for examples of this sort.

53 As noted by an anonymous reviewer, (38) is fine when 'now' is replaced by 'then'. We don't pursue an analysis of 'then' here, which has a wide array of uses (Shiffrin 1992, Roßdeutscher 2005). For some discussion about how 'then' differs from 'now', we refer the reader to Anand & Toosarvandani 2019.

54 This is still in line with the pure indexical account of 'now.' In such cases it is assumed there must be some antecedently set context we are not privy to, not that 'now' felicitously occurs without such antecedently set context. A complete understanding would require reconstructing such context, which is why such utterances seem incomplete in the first place.

is in line with it being a pure indexical as long as we allow that coherence relations can connect utterances with eventualities in the real-world situation they are about. This idea is independently well motivated (Stojnić et al. 2013, Stone & Stojnić 2015, Hunter et al. 2018).[55] So, in (39), Result holds between the kicking event and the state of pain, making the kicking event (and time right after it) prominent. 'Now' requires that feeling pain overlaps the consequent state of this event, and Result requires that the pain was caused by it. This is right: the speaker is in pain, because they were kicked. As before, the analysis also captures the "change of state" inference in (39): the relevant state resulted from the prior event of kicking.[56]

Just as it can comment on an event occurring in the speech situation, an utterance containing 'now' can also comment on the speech event itself, provided it is related to it via a suitable coherence relation.[57] With this in mind, reconsider (24):

(24)   I am happy now.

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55 On our account linguistic mechanisms can render a particular candidate interpretation prominent, antecedently setting the context for 'now,' which then selects its value automatically. This is still the case discourse initially: it is because the utterance bears a particular relation (e.g., Narration or Result) to some event in the world that *that* event is most prominent in the context when 'now' is interpreted. The relations set the input context and 'now' selects the consequent state of the prominent event in thus antecedently set context. See Stojnić et al. 2013 and Hunter et al. 2018.

56 An anonymous reviewer notes 'now' can also mark a contrast between some time during which the eventuality modified by it holds and some *future* time during which it doesn't. Our analysis is compatible with such contrastive interpretation, which can be invoked explicitly by employing the relation Contrast. Consider (i), from the reviewer:

(i)   We are (still) alright now. But in a couple of days all hell will break loose.

Assuming the first sentence is discourse initial, it is understood as commenting on some eventuality in the speech situation, connecting to it via a suitable relation. This eventuality could be some concurrent or just transpired event (see (39)), or the speech event itself (see (24)). For instance, the first sentence in (i) can be understood as elaborating on the speech event. 'Now' will then require the state of being alright to overlap the consequent state of the speech event and the present tense will require that it overlaps the utterance time. This generates the intuitively correct interpretation that being alright overlaps the consequent state of the speech event and the utterance time. Moreover, we capture the intuition that the discourse describes a contrast between how things are at the utterance time and some future time. The two utterances are connected by Contrast, which requires that the two sentences contribute contrasting information about some topic (here: how we are doing when). Indeed, this contrasting interpretation is generated by Contrast in (i) even without 'now.' We thank the anonymous reviewer for pressing this point.

57 There is precedence for thinking that the speech event is always promoted discourse initially, much like, e.g., the speaker is available as the referent for 'I' (see e.g., Bittner (2014)). While we agree that the speech event is contextually available, for it to be the most prominent eventuality, and so the one relevant for the interpretation of 'now,' it needs to be promoted by some prominence-affecting update. This will be the case if the utterance relates to the speech event via a suitable coherence relation.

As (39), (24) can be used to describe a result of an event that transpired in the speech situation: e.g., the speaker can use it upon learning they won the lottery. But it can also be used to elaborate on the speech event as well. In such case, Elaboration will promote the speech event (and its time), and 'now' will select it, requiring the onset of the eventuality described by its complement to overlap its consequent state. Since present tensed verbs phrases are stative (see f.n. 15), this just means that the described state (in this case, being happy) has to overlap the consequent state of the speech event. And, finally, since the clause is in the present tense, it is further required that the described state overlap the utterance time. This correctly predicts that the state of being happy temporally overlaps the speech event.

In contrast to (24), the past tense interpretation is infelicitous discourse initially:

(40)   I was happy now.

On our account, 'now' selects the prominent event and locates the state of being happy within its consequent state. Further the past tense requires that the state of happiness also overlaps some prominent past time. One immediate issue is that the discourse doesn't provide a prominent past time. And it is not easy to accommodate one out of the blue either, as witnessed by the oddity of (41):[58]

(41)   I was happy.

(41) is akin to hearing, e.g., 'He arrived yesterday' out of the blue: while one understands there has to be some salient male the speaker intends to select, there is not enough information to accommodate the antecedent. But suppose one could accommodate some such past time. We'd still need a prominent event as an antecedent of 'now.' But which event could this be?

Unlike (24), (40) (or (41)) cannot elaborate on the speech event. More generally, Elaboration doesn't support elaborating on presently occurring events via past tense descriptions; (42) is odd:

(42)   [Observing John type:] He was typing fast.

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58 Accommodating is hard but perhaps not impossible. An anonymous reviewer suggests one could accommodate a recent past time in examples like (i):

(i)   I was napping.

Assuming such accommodation is possible, it still doesn't make 'now' felicitous:

(ii)   I was napping now.

So, a failure of accommodation cannot be the whole explanation as to why such discourses are infelicitous.

This should not be surprising: the speech event is present. But, Elaboration requires its second argument to offer more information about (a part of) the event elaborated on, and the past tense description might not be suitable to offer an elaboration of a present event.[59]

Further, unlike (24), (41) cannot even be felicitously used to comment on some prominent event that just transpired. For instance, the speaker cannot utter (43) immediately after learning they won the lottery.

(43)   [Upon hearing one won the lottery:] I was happy, now.

Suppose we understood the utterance as describing the result of learning that one won. Then Result would make this event, and the time right after it, prominent. Wouldn't we predict that 'now' requires the state of happiness to overlap the consequent state of this event, and (due to the contribution of the past tense) that it overlaps the prominent time, the time of the consequent state — "the time right after"? So why isn't (43) felicitous? The problem is not in the analysis of 'now', but that one cannot use the simple past to select the time of the consequent state of present or recent events:

(44)   [Upon hearing one won the lottery:] I was happy.

(44) cannot be understood as describing the result of hearing that one won, even though, strictly speaking, hearing about the lottery and becoming happy temporally precedes being happy. The only available interpretation appears to be that the speaker is describing a result of something that happened *prior* to learning about the lottery, in the more distant past. A natural explanation for this is that we understand the consequent states of events that have just transpired as fully in the present. Of course, it is possible that a change of state transpires before the speaker starts speaking. But

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59 Elaboration allows the state described by its second argument to overlap the consequent state of an eventuality elaborated on, and Background similarly allows overlap between the state which serves as the ground and the onset or consequent state of the figure eventuality. Yet, the data seem to suggest that we conceptualize the events unfolding in the present as fully present, including their onset, and with their consequent states extending into the future. (42) does not support Elaboration, and similarly, present events don't support past tense descriptions of background circumstances via Background. E.g., (i) could not describe the background circumstances against which the event of turning off the light is taking place.

(i)   [Observing the janitor turning off the light in an empty room:] The room was empty.

Regardless of the preferred explanation for why stative descriptions in the past tense resist connecting to present events via suitable relations (e.g. Background or Elaboration), it is only expected that 'now' cannot be licensed in such constructions, either, since the relation is needed to make the event prominent. (Note, Result is clearly ruled out, as the resulting eventuality cannot pre-date its cause.)

unless such a change is obvious or explicitly introduced, past-tense utterances like (44) remain odd.[60] But if so, then stative descriptions in simple past (unlike simple present) resist being related, via Result, to descriptions of events that just transpired. So, it is unsurprising that 'now' in such discourses cannot select the consequent state of such events.[61] By contrast, in (43), we face no problem inferring Result, and 'now' is perfectly acceptable.

Finally, we can predict that 'now' can felicitously occur with future tense as well:

(45)   I will now introduce you to Teia.

(45) too can be used discourse initially to comment on either the speech eventuality, or an eventuality that transpired in the speech situation. Suppose one uses (45) to continue a narrative with respect to the speech event, describing what will happen next in the speech situation. Then Narration promotes the speech event (and the time right after it). 'Now' selects this event (the speech event), and locates the

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60 Consider:

(i)   (Upon hearing that she won the lottery:) I was happy for a moment, but then I remembered that I owe more than I won. So, I'm no longer happy now.

61 Similarly, simple past stative descriptions of states that still hold in the present resist being related to events that just transpired by other relations as well. For instance, the following cannot be seen as describing background circumstances of entering the room:

(i)   [Upon entering a dark room:] The room was dark.

Further, while you might use Elaboration to comment on an event that just transpired with a past tense stative description of a state that no longer holds in the present (as in examples like (ii)), it is clear why you cannot do so with 'now:' the state (of the cookie being delicious) would have to hold in the consequent of the eventuality described, which it doesn't.

(ii)   [Upon eating a cookie:] It was delicious (#now)!

Similarly, past tense descriptions can occur in Explanation connecting to just transpired or present events:

(iii)   a.   [Looking at John's scratching his blemishes:] He contracted chicken pox last week (#now).
           b.   [Upon the glass breaking:] It was fragile (#now).

But again, there is a ready explanation of why 'now' cannot occur in such past stative descriptions. 'Now' in (iii-a) would again require that the onset of contracting the chicken pox be in the consequent state of scratching, but that it also overlaps the onset of scratching, which cannot be satisfied. This is exactly what made (7) infelicitous. Meanwhile, in (iii-b), 'now' would require that the glass being fragile holds at the consequent state of the eventuality explained, but again, it doesn't.

onset of the introduction within its consequent state. Further, assuming that future 'will' is analogous to past and present, it selects the prominent future time — the time just promoted, i.e. the time right after the speech event — and requires that the introduction temporally overlaps this time.[62] Putting this together, we get the right prediction that the introduction will happen right after the speech event. To wit, (45) could be paraphrased as: 'There will be an introduction as soon as I'm done with this very speech act'. Without 'now', however, this paraphrase no longer holds of (45).

Utterances like (45) can also comment on the ongoing events in the speech situation:

(46)   [Seeing Teia enter:] I will now introduce you to Teia.

(46) continues a narrative, describing what will happen after the entrance. Narration makes the entrance, and time right after it prominent. Consequently, due to 'now,' the onset of the introduction is predicted to overlap the consequent state of the entrance (and further constrained to overlap a future time).

Taking stock, we see that our account not only captures interpretive constraints on discourse-bound uses of 'now,' but also correctly predicts a wide range of interpretive constraints on discourse initial uses of 'now,' including various interpretations of the uses of 'now' with present and future tense, as well as its distinctive infelicity in past tense discourse initial uses.

4   Conclusion

Traditionally, 'now' has been classified as a pure indexical: its standing linguistic meaning is a function that given a context automatically selects the utterance time. Despite its initial appeal, the traditional account has been forcefully challenged — 'now' allows for anaphoric, discourse-bound, uses, and can occur felicitously with past tense. The reaction to this challenge has typically been to treat 'now' as a true demonstrative, selecting the prominent time provided by the non-linguistic context or prior discourse. We have argued that this is doubly mistaken. First, it is mistaken with respect to the semantic value of 'now', which we have argued is not a time, but a state — the consequent state of a prominent event. Second, although 'now' is prominence-sensitive, it is nevertheless a pure indexical, in that its interpretation is determined by the (antecedently set) context, without recourse to extra-linguistic supplementation. That is, any occurrence of 'now' selects the consequent state of the most prominent event, and the event-prominence itself is linguistically maintained through coherence relations. We argued that our analysis accounts straightforwardly

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62 Nothing we say depends on this assumption about 'will.' Any adequate account of 'will' will have to explain its future directedness: i.e., that the time of introduction in (45) is in the future. Thanks to Bridget Copley (p.c.) for discussion.

for a wide-range of uses of 'now,' including discourse initial and discourse-bound uses, while giving it a simple, indexical meaning. We hope that our analysis sheds light and probes further questions for research that has looked into the use of 'now' in kinds of discourses that we did not look into here, e.g. Indirect Discourse, Free Indirect Discourse, and Historical Present. Moreover, further research is necessary to consider possible effects on event-prominence triggered by linguistic mechanisms other than coherence relations (e.g. prosody and other information structural cues), including how these different linguistic mechanisms interact. We leave these questions for future research.

5   Appendix

5.1   Vocabulary:

- The following are basic expressions:

  - Individual expressions:

    * Constants: $\mathbf{a}, \mathbf{b}, \ldots \mathbf{a}_n, \mathbf{b}_n$ for $n \in \mathbb{N}$.
    * Variables: e_n for $n \in \mathbb{N} \cup \{*, \upsilon, \Delta\}$.

  - A set of n-place predicates: ϕ_n for $n \in \mathbb{N}$.

  - An unary operator: @.

  - Identity predicate: =.

  - Connectives: $\wedge, \neg$.

  - The following are terms:

    * Individual expressions are terms.
    * Where @ is a unary operator, and P a predicate @P is a term.

- The following are atoms:

  - If ϕ is an n place predicate and $u_1, \ldots, u_n$ are terms, then $\phi(u_1, \ldots, u_n)$ is an atom.

  - If u_i and u_j are terms, then $u_i = u_j$ is an atom.

- The following are conditions:

  - All atoms are conditions.

  - If ϕ is a condition and ψ is a condition, then $\phi \wedge \psi$ is a condition.

  - If ϕ is a condition then $\neg \phi$ is a condition.

- The following are update expressions:

  - If ϕ is a predicate, then $\langle \phi \rangle$ is an update expression.

  - If K_1 and K_2 are update expressions, then $K_1; K_2$ is an update expression.

  - If $\langle \phi \rangle$ is an update expression then $\text{PAST}(\langle \phi \rangle)$ is an update expression.

  - If K_1, and K_2 are update expressions, then so are $NARRATION(K_1, K_2)$, $BACKGROUND(K_1, K_2)$, $ELAB(K_1, K_2)$, $RESULT(K_1, K_2)$, and $EXPLANATION(K_1, K_2)$.

  - If K is an update expression, then $NOW(K)$ is an update expression.

5.2 Models:

- A Frame is a tuple $F = \langle \mathscr{D}_w, R, \mathscr{D}_e, \mathscr{D}_\delta, \mathscr{D}_t \rangle$, where $\mathscr{D}_t$ is a domain of truth values ($\mathscr{D}_t = \{0, 1\}$), $\mathscr{D}_e$ is a domain of eventualities including a subdomain of states, $\mathscr{D}_\sigma$, and events, $\mathscr{D}_\eta$, such that $\mathscr{D}_\sigma \cap \mathscr{D}_\eta = \emptyset$, $\mathscr{D}_\sigma \cup \mathscr{D}_\eta = \mathscr{D}_e$, $\mathscr{D}_\delta$ a domain of times totally ordered by $\leq$ and $\mathscr{D}_w$ a finite domain of worlds, with R a transitive and reflexive accessibility relation defined over $\mathscr{D}_w$, such that $\mathscr{D}_t \cap \mathscr{D}_w = \mathscr{D}_w \cap \mathscr{D}_e = \mathscr{D}_t \cap \mathscr{D}_e = \mathscr{D}_t \cap \mathscr{D}_\delta = \mathscr{D}_w \cap \mathscr{D}_\delta = \mathscr{D}_e \cap \mathscr{D}_\delta = \emptyset$.

- A Model is a pair $\mathscr{M} = \langle \mathscr{F}, \mathscr{I} \rangle$, where $\mathscr{F}$ is a frame and $\mathscr{I}$ an interpretation function which assigns an element of $\mathscr{D}_e$ to individual expressions, and a subset of $\mathscr{D}_e$ to each predicate.

5.3 Meta-language abbreviations:

- For $t, t' \in \mathscr{D}_\delta, t < t'$ iff t immediately precedes t'; iff $t \leq t'$ and $t \neq t'$.

- For $t, t' \in \mathscr{D}_\delta, t > t'$ iff t immediately follows t'; iff $t' \leq t$ and $t \neq t'$.

- For $\varepsilon \in \mathscr{D}_e, {}^\triangleright(\varepsilon)$ is the consequent state of ε, if ε is an event, and ${}^\triangleright(\varepsilon) = \varepsilon$ otherwise.

- For $u \in \mathscr{D}_e, {}^\triangleleft(\varepsilon)$ is the onset of ε, if ε is an event, and ${}^\triangleleft(\varepsilon) = \varepsilon$ otherwise.

- For $t, t' \in \mathscr{D}_\delta, t \bigcirc t'$ iff t temporally overlaps t'.

- For $\varepsilon \in \mathscr{D}_e, \tau(\varepsilon)$ is the time of ε.

- For $t, t' \in \mathscr{D}_\delta, {}^\blacktriangleright(t) = t'$ iff $t' > t$; ${}^\blacktriangleright(\tau(\varepsilon)) := \tau({}^\triangleright(\varepsilon))$.

- For $t, t' \in \mathscr{D}_\delta, {}^\blacktriangleleft(t) = t'$ iff $t > t'$; ${}^\blacktriangleleft(\tau(\varepsilon)) := \tau({}^\triangleleft(\varepsilon))$.

5.4 Stack Operations:

- A stack is a function defined on a finite convex subset of $\mathbb{N}$ plus $\{*, \upsilon, \Delta\}$ mapping onto a set $\mathscr{D}_e \cup \mathscr{D}_\delta \cup \{\bot\}$ (where $\bot$ is the undefined element).[63] The following are operations on stacks:

    - Where $m \in \mathbb{N}$, and i is a stack, i_m is the mth member of the stack if m is within the domain of definition of i, undefined otherwise. (i_* is the member of the stack stored at the designated position $*$, i_υ is the member of the stack stored at the designated position υ, and i_Δ is the member of the stack stored at the designated position Δ.)

    - For $m, n \in \mathbb{N}$, and a stack i, $i_{m,n}$ is a stack j defined on the set $\{0, \ldots, n - m\} \cup \{*, \upsilon, \Delta\}$ such that for $k \in \mathbb{N}$, $j_k = i_{(m+k)}$ if j is defined on k, and $j_* = i_*$, $j_\upsilon = i_\upsilon$, $j_\Delta = i_\Delta$.

    - For $m \in \mathbb{N}$, and a stack i, $i_m \ldots$ is the stack j defined on the set $\{k \in \mathbb{N} \mid i$ is defined at $(m + k)\} \cup \{*, \upsilon, \Delta\}$ such that, for $k \in \mathbb{N}$, $j_k = i_{(m+k)}$ and $j_* = i_*$, $j_\upsilon = i_\upsilon$, $j_\Delta = i_\Delta$.

    - If i is a stack with a finite domain with maximal element $k - 1$ then for a stack j, $i + j$ is a stack h where, for $x \in \mathbb{N}$, $h_x = i_x$ if i is defined at x, and $h_x = j_{(x-k)}$ otherwise (and $h_* = i_*$, $h_\upsilon = i_\upsilon$, $h_\Delta = i_\Delta$).

    - Where $u \in \mathscr{D}_e \cup \mathscr{D}_\delta$ and i is a stack, u, i is a stack j, such that $j_0 = u$, and for all $n \in \mathbb{N}$, such that $n > 0$, $j_n = i_{(n-1)}$ if i is defined on n, and $j_n = \bot$ otherwise and $j_* = i_*$, $j_\upsilon = i_\upsilon$, $j_\Delta = i_\Delta$.

    - For stacks i and j, $i \underset{n}{\sim} k$ iff $i_m = j_m$ for all $m, m \neq n$ (where $m, n \in \mathbb{N} \cup \{*, \upsilon, \Delta\}$).

    - For stacks i and j, $i \underset{n}{\approx} j$ iff $j_{0,n-1} + j_{n+1 \ldots} = i$ (where $m, n \in \mathbb{N} \cup \{*, \upsilon, \Delta\}$).

    - If i is a stack, then $\theta(i)$ is the first element of i, u, such that $u \in \mathscr{D}_\delta$.

    - If i is a stack, then $p(i)$ is the first element of i, u, such that $u \in \mathscr{D}_\delta$ and $u < i_\Delta$.

5.5 Semantics:

- The interpretation of atoms relative to an interpretation function $\mathscr{I}$, an assignment g:

    - $[\![\mathbf{e}]\!]^g = \mathscr{I}(\mathbf{e})$, if $\mathbf{e}$ is a constant.

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63 υ and Δ store the utterance event and its time, respectively. We assume these slots are updated automatically with the event of speaking up and its run-time.

- $[\![e_i]\!]^g = g_i$, for $i \in \mathbb{N} \cup \{*, \upsilon, \Delta\}$, if e_i is a variable.

- The interpretation of conditions:

  - Where ϕ is an n-place predicate and $t_1, \ldots, t_n$ individual expressions, then $[\![P(t_1, \ldots, t_n)]\!]^g = 1$ iff $\langle [\![t_1]\!]^g, \ldots, [\![t_n]\!]^g \rangle \in \mathscr{I}(P)$.
  - Where ϕ is a one-place predicate, $[\![@\phi]\!]^g = \bot$ if $g_0 = \bot$; $[\![@P]\!]^g = g_0$, if $g_0 \in \mathscr{I}(P)$; $[\![@P]\!]^g = [\![@P]\!]^{g_1 \cdots}$ otherwise.
  - $[\![u = u']\!]^g = 1$ iff $[\![u]\!]^g = [\![u']\!]^g$.

- The interpretation of dynamic updates; dynamic updates are interpreted as relations on sequences:

  - $[\![\langle\phi\rangle]\!](g, g')$ iff $\exists g''$ such that $g \underset{*}{\sim} g''$ & $[\![\phi(e_*)]\!]^{g''}$ & $g'' \underset{0}{\approx} g'$ & $g'_0 = g''_*$.

    * Basic update: promotes an eventuality.

  - $[\![K_1; K_2]\!](g, g')$ iff $\exists g''$, s.t., $[\![K_1]\!](g, g'')$ & $[\![K_2]\!](g'', g')$.

  - $[\![PAST(K)]\!](g, g')$ iff $\exists g''$ such that $[\![K]\!](g, g'')$ & $p(g) \circ \tau(g''_*)$ & $g'' \underset{0}{\approx} g'$ & $g'_0 = {}^{\blacktriangleright}(\tau(g''_*))$.

    * Constrains an eventuality to overlap the most prominent past time.

  - $[\![NARRATION(K_1, K_2)]\!](g, g')$ iff $\exists g'', g''', g''''$ s.t. $[\![K_1]\!](g, g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau({}^{\triangleright}(g'''_0))$ & $[\![K_2]\!](g''', g')$ & $Narration(g''_*, g'_*)$

    * Update associated with Narration, where $Narration(e, e')$ iff $e, e' \in \mathscr{D}_e$, and e' continues a narrative with respect to e; i.e., the time of the onset of e' is the time of the consequent state of e.

  - $[\![BACKGROUND(K_1, K_2)]\!](g, g')$ iff $\exists g'', g''', g''''$ s.t. $[\![K_1]\!](g, g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(g'''_0)$ & $[\![K_2]\!](g''', g')$ & $Background(g''_*, g'_*)$

    * Update associated with Background, where $Background(e, e')$ iff $e, e' \in \mathscr{D}_e$, and e' is a ground for the figure e, i.e., it provides background circumstances against which e occurs.

  - $[\![ELABORATION(K_1, K_2)]\!](g, g')$ iff $\exists g'', g''', g''''$ s.t. $[\![K_1]\!](g, g'')$ & $g''' \underset{0}{\approx} g''$ & $g''_* = g'''_0$ & $g'''' \underset{0}{\approx} g'''$ & $g''''_0 = \tau(g'''_0)$ & $[\![K_2]\!](g''', g')$ & $Elaboration(g''_*, g'_*)$

∗ Update associated with Elaboration, where $Elaboration(e,e')$ iff $e,e' \in \mathscr{D}_e$, and e' is a part of, and provides further information about e.

– $\llbracket RESULT(K_1,K_2) \rrbracket(g,g')$ iff $\exists g'',g''',g''''s.t.\llbracket K_1 \rrbracket(g,g'')$ & $g''' \approx_0 g''$ & $g''_* = g'''_0$ & $g'''' \approx_0 g'''$ & $g''''_0 = \tau(^{\triangleright}(g'''_0))$ & $\llbracket K_2 \rrbracket(g'''',g')$ & $Result(g''_*,g'_*)$

∗ Update associated with Result, where $Result(e,e')$ iff $e,e' \in \mathscr{D}_e$, and e' results from e (that is, e' is caused by, or is explained by e).

– $\llbracket EXPLANATION(K_1,K_2) \rrbracket(g,g')$ iff $\exists g'',g''',g'''',g''''',g''''''s.t.$ $\llbracket K_1 \rrbracket(g,g'')$ & $g''' \approx_0 g''$ & $^{\triangleleft}(g''_*) = g'''_0$ & $g'''' \approx_0 g'''$ & $g''''_0 = \tau(g'''_0)$ & $\llbracket K_2 \rrbracket(g'''',g''''')$ & $g'''''' \approx_0 g'''''$ & $g''''''_0 =^{\triangleright}(g''_*)$ & $g'''''' \approx_0 g'$ & $g'_0 = \tau(g''''''_0)$ & $Explanation(g''_*,g'_*)$.

∗ Update associated with Explanation, where $Explanation(e,e')$ iff $e,e' \in \mathscr{D}_e$ and e' explains e.

– $\llbracket NOW(K) \rrbracket(g,g')$ iff $\llbracket K \rrbracket(g,g')$ & $\tau(^{\triangleleft}(g'_*)) \bigcirc {}^{\triangleright}(\llbracket @EV \rrbracket^g)$, where $\llbracket @EV \rrbracket^g$ is the top-ranked event in g.

5.6 Truth, Validity and Entailment

• K is true relative to an assignment g and a model $\mathscr{M}$, just in case there is an assignment g', s.t. $\llbracket K \rrbracket(g,g')$.

• K is valid just in case it is true in all models $\mathscr{M}$, relative to all assignments.

• K entails H just in case for any model $\mathscr{M}$, and assignment g,g', if $\llbracket K \rrbracket(g,g')$ then there is a non-empty g'', s.t. $\llbracket H \rrbracket(g',g'')$.

5.7 Worked out Examples

(47) I hit him because he hit me.

a. *Meaning representation (ϕ corresponds to the description of an event of the speaker hitting the male, and ψ to the one of the speaker being hit by him):*
   (I) $EXPLANATION(PAST(\langle\phi\rangle),PAST(\langle\psi\rangle)$

b. Derivation:

i. $\llbracket EXPLANATION(PAST(\langle\phi\rangle),PAST(\langle\psi\rangle)) \rrbracket(g,g')$ iff $\exists h,h',h'',h''',h''''$, $\llbracket PAST(\langle\phi\rangle) \rrbracket(g,h)$ & $h' \approx_0 h$ & $^{\triangleleft}(h_*) = h'_0$ & $h'' \approx_0 h'$ & $h''_0 = \tau(h'_0)$ &

$\llbracket PAST(\langle\psi\rangle)\rrbracket(h'',h''')$ & $h''' \approx_0 h''''$ & $h_0'''' =^{\triangleright}(h_*)$ & $h'''' \approx_0 g'$ & $g_0' = \tau(h_0'''')$
& $Explanation(h_*,g_*')$.

ii. Take such g,h,h',h'',h''',h'''' and g'.

iii. Then $\llbracket PAST(\langle\phi\rangle)\rrbracket(g,h)$.

iv. $\llbracket PAST(\langle\phi\rangle)\rrbracket(g,h)$ iff $\exists j$ such that $\llbracket\langle\phi\rangle\rrbracket(g,j)$ & $p(g) \circ \tau(j_*)$ & $j \approx_0 h$ & $h_0 =^{\blacktriangleright}(\tau(j_*))$.

v. Take such j.

vi. Then, $\llbracket\langle\phi\rangle\rrbracket(g,j)$.

vii. $\llbracket\langle\phi\rangle\rrbracket(g,j)$ iff $\exists m$ such that $g \sim_* m$ & $\llbracket\phi(e_*)\rrbracket^m$ & $m \approx_0 j$ & $j_0 = m_*$.

Take such m. This is the truth-conditional contribution of the first utterance. The top-ranked event in j ($j_0 = m_* = j_* = h_*$) is required to be an event of hitting by the speaker of the prominent male that, by (iv), overlaps the top-ranked past time in g, that is, (by (i)), in the initial input assignment. (In other words, it is required that there is a hitting event of the prominent male by the speaker (j_0), overlapping a prominent past time in the input assignment ($p(g)$).) So, the formula is true just in case the speaker hit the prominent male at a time overlapping the prominent past time discourse initially.

viii. By (i) and (ii), $\llbracket PAST(\langle\psi\rangle)\rrbracket(h'',h''')$.

ix. $\llbracket PAST(\langle\psi\rangle)\rrbracket(h'',h''')$ iff $\exists k$ such that $\llbracket\langle\phi\rangle\rrbracket(h'',k)$ & $p(h'') \circ \tau(k_*)$ & $k \approx_0 h'''$ & $h_0''' =^{\blacktriangleright}(\tau(k_*))$.

x. Take such k.

xi. Then, $\llbracket\langle\psi\rangle\rrbracket(h'',k)$.

xii. $\llbracket\langle\psi\rangle\rrbracket(h'',k)$ iff $\exists i$ such that $h'' \sim_* i$ & $\llbracket\psi(e_*)\rrbracket^i$ & $i \approx_0 k$ & $k_0 = i_*$.

Take such i. This gives the truth-conditional contribution of the second utterance. An event of hitting by the prominent male of the speaker, $k_0 = i_* = k_*$, is required (by (ix)) to overlap the top-ranked past time in h'', which by (i), is the time of the onset of h_*, which, by (iv), is the time of the onset of the hitting event of the prominent male by the speaker.

xiii. By (i), it is further required that h_* (which, by (iv), is identical to j_*), that is, an event of hitting by the speaker of the prominent male, is explained by

g'_* (which by (ix) and (i) is identical to k_*), that is, an event of hitting by the addressee of the speaker that temporally overlaps the onset of h_*.

xiv. So, by (vii), (xii) and (xiii), and the definition of truth, the formula in (I) is true (relative to an input context g) just in case an event of the speaker hitting the prominent male, which overlaps some prominent past time (in the input context g) is explained by an event of the male hitting the speaker, which overlaps the onset of the former event. Simply: it is true just in case the speaker hit the male (during some prominent time in the past) because he hit the speaker first, at the onset of this event.

(48)   I hit him because he now hit me.

a.   *Meaning representation (ϕ corresponds to the description of an event of the speaker hitting the male, and ψ to the one of the speaker being hit by him):*

(II) $EXPLANATION(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))$

b.   Derivation:

i. $[\![EXPLANATION(PAST(\langle\phi\rangle), NOW(PAST(\langle\psi\rangle)))]\!](g, g')$ iff $\exists h, h', h'', h''',$ h'''', such that $[\![PAST(\langle\phi\rangle)]\!](g, h)$ & $h' \approx_0 h$ & $^{\lhd}(h_*) = h'_0$ & $h'' \approx_0 h'$ & $h''_0 = \tau(h'_0)$ & $[\![NOW(PAST(\langle\psi\rangle))]\!](h'', h''')$ & $h''' \approx_0 h''''$ & $h''''_0 = {}^{\rhd}(h_*)$ & $h'''' \approx_0 g'$ & $g'_0 = \tau(h''''_0)$ & $Explanation(h_*, g'_*)$.

ii. Steps ii–vii are exactly as in (I)..

viii. By (i) and (ii), $[\![NOW(PAST(\langle\psi\rangle))]\!](h'', h''')$.

ix. $[\![NOW(PAST(\langle\psi\rangle))]\!](h'', h''')$ iff $[\![PAST(\langle\psi\rangle)]\!](h'', h''')$ & $t(^{\lhd}(h'''_*)) \circ {}^{\rhd}([\![@EV]\!]^{h''})$

x. Further, $[\![PAST(\langle\psi\rangle)]\!](h'', h''')$ iff $\exists k$ such that $[\![\langle\phi\rangle]\!](h'', k)$ & $p(h'') \circ \tau(k_*)$ & $k \approx_0 h'''$ & $h'''_0 = {}^{\rhd}(\tau(k_*))$.

xi. Take such k.

xii. Then, $[\![\langle\psi\rangle]\!](h'', k)$.

xiii. $[\![\langle\psi\rangle]\!](h'', k)$ iff $\exists i$ such that $h'' \sim_* i$ & $[\![\psi(e_*)]\!]^i$ & $i \approx_0 k$ & $k_0 = i_*$.

Take such i. We now get the truth-conditional contribution of the second clause. An event of the speaker hitting the male, $k_* = i_* = k_0$, must overlap the top-ranked past time in h'', which by (i), is the time of the onset of h_*, i.e, by (iv), of the onset of the speaker hitting the male. Further, by (ix) and

(xiii) — i.e., given the effect of 'now' — the time of the event described by the second sentence must overlap the consequent state of the top-ranked event in h'', the hitting event described by the first sentence (by (i), (iv) and vii). Finally, the event of the speaker hitting (h_*) must be explained by the event of the speaker being hit (k_*, i.e., by (i), g'_*). This means that this event, k_*, has its onset during the consequent state of the hitting event described by the first sentence (h_*), and temporally overlaps its onset. Since the consequent state of an event necessarily comes after its onset, and an event cannot temporally overlap a time before its onset, we derive a contradiction. Given (i), (vii) and (xiii), and the definition of truth, ((II)) is true (given an input context g) just in case there's an event of the speaker hitting the male during some prominent time in the past, because of the male hitting the speaker, which had its onset during the consequent state of this event, but temporarily overlaps its onset. The truth-condition is inconsistent: no event can satisfy this.

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