Underspecified Tense semantics and embedded Tense effects

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Abstract

In this paper, we provide a novel, underspecification account of past tense semantics, which explains the systematic availability of both backward-shifted and simultaneous readings in past-under-past embeddings—a phenomenon commonly referred to as Sequence of Tense (SoT)—without assuming ambiguity at the level of LF. We show that this approach fairs at least equally well as other existing SoT analyses in terms of the range of data it can account for, and that it has additional advantages over them as well, such as retaining the one-to-one mapping between past tense form and past tense meaning.

We move on to demonstrate that the proposed underspecification account is straightforwardly extendable to present tense embeddings. The crucial component of this part of the proposal is that we suggest, along with others such as Heim (1994); Altshuler (2016), though also substantially different from them, that what has commonly been argued to be an exceptional reading of present tense embeddings, i.e., the double-access reading, actually contributes the present tense's inherent meaning.

Lastly, we argue that the semantic contributions of present and past tense that we propose can be straightforwardly implemented in pronominal terms, as well. Since the proposed analysis does not rely on distinct LFs for the derivation of the backward-shifted and the simultaneous readings of past-embedded past tense, we show that SoT effects can be explained without the assumption of additional machinery, such as *res*-movement or concept-generators. The same holds, we argue, for the double-access reading of present-under-past embeddings.

1 Introduction

Typically, past tense morphology systematically marks that the event expressed by the verb or predicate of a sentence is located prior to the time of utterance (1), whereas present tense morphology denotes that the sentence's event time is ongoing at the time of utterance (2):

(1) Mary *was* ill (*now/last year/*next year).

(2) Mary *is* ill (now/*last year/*next year).

Nevertheless, it is well-established in the literature that for either of the two tenses this is not always the case. Across different matrix embeddings, the meaning of their tense morphemes appears to vary: In past-under-past embeddings, the contribution of embedded past tense morphology may appear to be vacuous (cf. Section 1.1); The semantic contribution of present tense morphology sometimes appears to anchor an event to some local evaluation time rather than just anchoring it to the utterance time (cf. Section 1.2). In this article, we propose a novel syntactic-semantic account for past and present tense that can explain the full range of their behavior while retaining a one-to-one mapping between tense form and meaning. Before outlining the structure of the argument, let us briefly recapitulate why embedded tenses pose such an interesting and important puzzle to solve.

1.1 Embedded past tense

It has long been known that sentences in which a past tense is embedded under a matrix past have two readings: a simultaneous (sim) and a backward-shifted (b-s) one, where the former constitutes the most salient interpretation.

(3) John said Mary was ill.
   a. John, at some $t' <$ utterance time, t_u : "Mary is ill." [sim]
   b. John, at some $t' < t_u$: "Mary was ill." [b-s]

The availability of the sim reading for past-under-past constructions is commonly referred to as Sequence of Tense (SoT) and has been a prevalent topic of research for an extensive period of time (see, e.g., Curme (1931); Jespersen (1931)). One reason for the continuing interest is that, intuitively, there are two ways to think about past tense, and each of them fails to predict the two-fold meaning distinction observed in (3). Leaving the various implementation variants on the market aside for now, the puzzle boils down to the following:

Under an *absolute* view on past tense, each instance of past tense is taken to place the event time of the predicate it scopes over prior to the sentence's utterance time (cf., e.g., Reichenbach, 1947; Prior, 1967; Comrie, 1985; Declerck, 1995, 2015).

(4) $[\![\text{PAST}_{\text{absol.}}]\!] = \lambda P.\ \exists t' < t_u\ \&\ P(t')$

In clauses in which a past tense morpheme is embedded under a matrix past, two such prior-to-t_u relations are established, but their internal order is not further specified.

(5) John $\underbrace{\text{say-PAST}}_{\exists t_1 < \underline{t_u}\ \&\ say(t_1)}$ Mary $\underbrace{\text{be-PAST}}_{\exists t_2 < \underline{t_u}\ \&\ be{-}ill(t_2)}$ ill.

Such a view correctly predicts the availability of the sim and the b-s readings for past-under-past sentences (i.e., the temporal orderings $t^2 < t^1 < t_u$ and $t^2 = t^1 < t_u$, respectively). At the same time, however, it also, incorrectly, predicts a forward-shifted (f-s) interpretation to be available, falsely supporting the following paraphrase for (3). A purely absolute theory of past tense cannot provide a final answer to the puzzle.

(6) John, at some $t < t_u$: "Mary will be ill." [f-s]
   (temporal ordering: $t^1 < t^2 < t_u$)

The second intuitive way to look at past tense is to regard it as a *relative* tense. Under such a view, each instance of past tense is assumed to place the event time of the predicate it scopes over prior to the predicate's local evaluation time[1], which is provided by its closest c-commanding tense, or, in the absence of such a tense, the utterance time (cf., e.g., Prior, 1967).

(7) a. $[\![\text{PAST}_{\text{rel.}}]\!] = \lambda P.\ \lambda t^*.\ \exists t' < t^*\ \&\ P(t')$
   b. John $\underbrace{\text{say-PAST}}_{\exists t_1 < \underline{t_u}\ \&\ P(t_1)}$ Mary $\underbrace{\text{be-PAST}}_{\exists t_2 < \underline{t_1}\ \&\ Q(t_2)}$ ill.

[1] Note that we take *local evaluation time* here to be the time that the attitude holder self-locates herself.

In contrast to an absolute view on past tense, adopting a relative view correctly rules out a f-s interpretation of (3), since the matrix tense provides the local evaluation time of the embedded tense. At the same time, however, such a proposal fails to predict the availability of the sim reading. The only reading it, correctly, predicts is the b-s one. Hence, neither of the two intuitive views on past tense explains the systematic two-fold meaning distinction of English past-under-past constructions.

To solve this problem, it has become received wisdom in most SoT literature that there exists some mechanism by means of which the embedded past tense may lose its semantic contribution in SoT contexts. Implementations of this insight vary, among others, from the assumption of a void tense in SoT-languages (Partee, 1973; Heim, 1994; Kratzer, 1998), to a past tense which is, in fact, a present-in-disguise (Ross, 1989; Abusch, 1988, 1997), an optional tense deletion mechanism constrained by syntax (Ogihara, 1995; Stowell, 1995, 2007), and hybrid approaches (Kusumoto, 1999; von Stechow, 2009; von Fintel & Heim, 2016). Irrespective of the different manners of implementation, however, an assumption shared by all of these proposals is Logical Form (LF)-ambiguity between the sim and b-s reading. A notable exception to this assumption is provided by pragmatic approaches such as Altshuler (2016) and Altshuler and Schwarzschild (2012) that explore the presence or absence of cessation implicatures (discussed more extensively in Section 3.4). The assumption that past-under-past embeddings are ambiguous is also what we challenge in this paper. Nevertheless, instead of providing a pragmatic solution to the SoT problem, we argue that past tense is semantically *underspecified* and therefore compatible with both sim- and b-s readings, though crucially not with f-s readings.

1.2 Embedded present tense

A similar puzzle to the one presented for embedded past tense morphology can be observed for embedded present tense morphology: Present tense, too, can be interpreted in one of two different ways, depending on the matrix environment (cf. (8)). In (8a), an instance of present-tense morphology is embedded under a future-shifted matrix tense. This setting leads to a simultaneous (sim) interpretation of the present-tensed complement clause; i.e., one in which the time of Mary's illness is understood to include the time of John's saying event—which lies in the strict future of t_u—but not necessarily the utterance time t_u itself. The example in (8a) can therefore be feasibly paraphrased as follows: *John, at some t later than t_u: "Mary is ill (now)."* In (8b), by contrast, in which present tense morphology is embedded under a past-tensed matrix verb, the present tense is interpreted as fulfilling a different, dual role: It anchors the time of Mary's illness to both the utterance time and the time of John's saying, i.e., its local evaluation time. As a result, (8b) is interpreted to be true if and only if both *Mary is ill at t_u* and *Mary is ill at some t prior to t_u*, where t denotes the time of John's saying event. Such a reading of embedded present tense morphology is commonly referred to as a double-access (d-a) reading.

(8) a. John will say Mary is ill. [sim]

b. John said Mary is ill. [d-a]

As with past tense, the established two-way meaning distinction of present tense in different environments poses a puzzle to traditional relative/absolute views on tense. A *relative* view on present tense predicts that each instance of present tense morphology includes its respective local evaluation time; an *absolute* view on present tense tense proposes that present tense morphology always establishes an inclusion relation with respect to t_u (cf. Prior, 1967; Comrie, 1985; Declerck, 1995, 2015). The above data show that neither view can capture the full meaning of present tense: Whereas (8a) provides evidence for a relative and not an absolute view on present tense—as no reference to t_u is made—the example in (8b) refutes such a view: When embedded under a past matrix verb, present tense *always* makes reference to t_u in addition to to its local evaluation time. Hence, neither the relative nor an absolute view of present tense readily explains the attested readings, proving that present tense meaning should be more complex. Again, the leading intuition in the literature is that the respective embedded present tense meanings should be derived on the basis of different LF structures; one in which the tense contribution is deleted, leading to the sim interpretation, and one where it is not, yielding a d-a reading.

Even though the ambiguity of past tense morphology has received a lot of attention in the literature, the present tense morphology-counterpart of the puzzle seems to have been discussed less extensively so far. This might be due to the fact that, *prima facie*, the cases of past- and present tense morphology-ambiguity do not seem directly related, as the two-way meaning distinction of the former reveals itself within a sentence, whereas the two-way meaning distinction of the latter only reveals itself across different embedding contexts. Nevertheless, a closer inspection shows that they can be analyzed in a parallel manner. Such a unified treatment should be able to capture the meaning distribution of both past and present tense and, thus, incorporate an absolute as well as a relative meaning component. That is indeed what we will provide in this paper.

1.3 Outline of paper

The paper is structured as follows: In Section 2, we propose a past tense semantics that is underspecified between simple past tense and past perfect meaning. For our implementation we follow, among others, Kusumoto (1999, 2005); Stowell (2007) in disentangling the different meaning components of past tense via outsourcing its absolute past meaning into a structurally high, covert past operator (*Op-PAST*) while encoding its relative past meaning into the past tense morpheme (*-ed*), which is syntactically dependent on the aforementioned operator. The novel contribution of our account lies in the proposition that past tense morphemes contribute an underspecified past tense semantics in their relative meaning, essentially a relative non-future, which yields the desired underspecified meaning. For this, we also provide independent motivation for assuming such underspecified past tense semantics.

After introducing the proposal, we apply it to standard SoT cases, as well as more complex cases of temporal embeddings in Section 3, and show that it derives the correct truth conditions for each case. The more complex cases include, e.g., cases in which an embedded past tense morpheme receives a future-oriented interpretation or an interpretation that seems to be temporally independent from the closest evaluation time. Subsection 3.2 here explains

the deviant behavior of past tense in complement clausal embeddings, and Subsection 3.3 explains the deviant behavior of past tense in (non-restrictive) relative clauses. In the final part of this section, we compare our proposal to existing ambiguity and non-ambiguity approaches in Section 3.4.

Section 4 is devoted to demonstrating that the same mechanism can also be straightforwardly extended to present tense; An underspecified present tense proposal akin to the one proposed for past tense, i.e., containing an absolute and a relative meaning component, yields the correct semantics both for matrix and embedded tenses, including challenging embeddings.

In Section 5, we show that our approach is not only fully compatible with quantificational approaches, but also with pronominal tense semantics to tense semantics without having to adopting extra technical machinery.

Section 6 concludes.

2 The proposal

We start our analysis with the well-established observation that past tense takes higher scope than its surface position (Klein, 1994; Ogihara, 1996; Abusch, 1997; Kusumoto, 1999, 2005; von Stechow, 2002; Stowell, 1995, 1996, 2007; Zeijlstra, 2012). This means that past tense is not interpreted on the finite verb, i.e., where its morphology occurs, but rather at a higher level in the sentence. Evidence for such a scopal ordering of past tense comes, for instance, from examples like the following:

(9) Wolfgang played tennis on every Sunday. (von Stechow, 2006)

The intended interpretation of (9) is one in which past tense outscopes the distributive quantifier *every Sunday*, which in turn outscopes the lexical verb *play*, yielding the paraphrase in (10a). The scopal order where past tense would take scope at its surface position, i.e., under *every Sunday*, amounts to the reading in (10b), which is absent (cf. von Stechow, 2002, 2005; Zeijlstra, 2012).

(10) a. 'There exists a past interval t such that for every Sunday in t, Wolfgang plays tennis.'

b. *'For every Sunday, there exists a time before it such that Wolfgang plays tennis at that time.'

That there exists a covert past tense operator outscoping the distributive quantifier in (9) can furthermore be shown by expressing the operator explicitly. Crucially, the resulting sentence is truth-conditionally equivalent to (9):[2]

[2] We thank Jacopo Ramoli and Manfred Krifka (p.c.) for independently pointing out that there exist scenarios in which the fact that past tense usually takes highest scope does not always hold true. Consider the following utterance, addressing a person who keeps re-telling the same story, but reliably changes their role in it. In such a context, we understand the distributive quantifiers in (11) to raise across the past tense:

(11) Every Sunday you were a hero, but every Monday you were a coward.

Investigating such interactions will be left to future research.

(12) In the past, Wolfgang played tennis on every Sunday.

From the correct reading in (10a) it becomes evident that the distributive quantifier takes scope from an intermediate position between the lexical verb and the past operator, clearly revealing the dichotomy between the locus of interpretation and the locus of morphological instantiation of past tense. Therefore, we assume—again in line with many others (e.g., Kusumoto (1999, 2005); von Stechow (2003); Stowell (1995, 1996, 2007); Zeijlstra (2012))—that the past tense morpheme does not carry canonical past tense semantics. Instead, we propose alongside them that 'real' past tense meaning, i.e., anteriority, is contributed by a structurally higher, covert past tense operator *Op-PAST*, whose presence is triggered when past tense morphology is used. One important role of past tense morphology is then to indicate the existence of a structurally high past tense operator. Syntactically, such a relation is commonly implemented by assuming past tense morphology to carry an uninterpretable past feature [uPAST], which is checked by a matching interpretable feature [iPAST], carried by *Op-PAST*. We assume this covert past tense operator to carry the following semantic content:

(13) $[\![\ \textit{Op-PAST}\ ]\!] = \lambda t^*.\ \lambda P.\ \exists t < t^*\ \&\ P(t)$

Op-PAST places the predicate P at a time t prior to some local evaluation time t^*. At matrix level, t^* by default applies to t_u and for the sake of simplicity we will take *Op-PAST* to denote $[\ \lambda P.\ \exists t < t_u\ \&\ P(t)\ ]$ in these cases. Later in this paper we will discuss examples in which the value deviates from the default, though, providing evidence for the necessity of the more complex definition of the operator given in (13).

We crucially depart from other approaches by building up on the fact that even though the locus of past tense is different from its overt instantiation—i.e., the tense marker *-ed*—, this does not entail that the past tense morpheme is semantically vacuous. There is nothing that *a priori* prevents the past tense morpheme to bring in an additional meaning component. Concretely, we take the meaning of a past tense morpheme, like *-ed*, to be comprised of two components: a syntactic feature [uPAST], which encodes a dependency with a higher past tense operator (as discussed above), and a semantic element that we assume to have the meaning of a relative non-future. Both the covert operator and the past tense morpheme are thus semantically active (just as in syntactic dependencies like binding of an anaphor by an antecedent, or when movement leaves a trace, both participants in the dependency are semantically active).

Semantically, the past tense marker (*-ed*) for us then encodes a relative non-future meaning with respect to its closest c-commanding tense node (informally: 'not later than'), an assumption that will ultimately lead to the underspecified interpretation of past-under-past embeddings we propose. Formally, we assign the following denotation to the past tense marker:

(14) $[\![\text{-ed}\ ]\!] = \lambda t.\ \lambda P.\ \exists t'.\ t' \leq t\ \&\ P(t')$

As stated in the definition, in this context, the expression $t' \leq t$ is taken to mean that the lower boundary of the time interval t' is not later than the lower boundary of the time interval t. Hence, an event happening at time t' starts either strictly earlier than or at the same time as an event happening at time t, but never completely succeeds it.

With these assumptions in place, a mono-clausal past-tensed sentence such as *Susan loves her mother* receives the following interpretation:

(15) Susan loved her mother.

a. [*Op-PAST*$_{[\text{iPAST}]}$ [Susan love-ed$_{[\text{uPAST}]}$ her mother]]
$\exists t' < t_u$ $\exists t^2 \leq t'$

b. $\exists t' < t_u$ & [$\exists t^2 \leq t'$ & love(Susan, her mother, t^2)]

c. *There is a time t' strictly before the utterance time t_u and Susan's loving her mother starts at a time no later than t'.*

Note that the proposed analysis makes no hard commitment with respect to whether Susan loves or fails to love her mother at/after t_u; rather, it restricts the contexts in which (15) can be felicitously uttered to those in which Susan's loving her mother started prior to t_u. The proposal is therefore fully compatible with the well-established fact that even though a past tensed stative sentence may infer that the described state ceased to hold, it never entails that.

Our proposal deviates from standard analyses in that it introduces vagueness with respect to the ordering of t' and t^2 in (15): They either refer to the same point in time or the latter precedes the former; In this sense, a clause containing a single past tense morpheme should be able to yield both a regular past tense interpretation and an interpretation very close to that of a past perfect. At first sight, this seems like a counterintuitive complication of the meaning of past tense. However, this additional relative non-future semantics of the past tense morpheme is empirically well supported. If t' and t^2 are taken to refer to the same point in time, the most prominent interpretation of the sentence, a simple past reading (*Susan loved her mother at a time prior to t_u*), is derived. Crucially, though, there are contexts in which a speaker may choose to use a simple past-tensed sentence even though the interpretation she wants to trigger is actually more comparable to a past perfect one and, thus, t' is to be interpreted to precede t^2. One such context is the following:

(16) a. Did Susan go to today's 4pm class?

b. No, she left for Spain.

The intended interpretation of (16b) is one that places Susan's leaving for Spain *prior to* 4pm today, i.e., prior to a past reference time in the sense of Reichenbach (1947).

Most likely due to pragmatic blocking effects, this ambiguity of past tense usually remains unnoted in unembedded sentences as the same information can, more transparently, be expressed via a past-perfect construction. Interestingly, however, the preference to use past perfect over simple past tense in contexts like (16) seems to decline with time, as has been shown in literature on language change (cf., e.g., Bowie, Wallis, and Aarts (2013); Gorrell (1995); Michaelis (1998)). For instance, Bowie et al. (2013) reports a significant decline of the past perfect across contexts (-34% per-million-words frequency across two subcorpora[3]),

[3] Bowie et al. (2013) investigates the change in usage of the (general) perfect in spoken standard British English based on the *Diachronic Corpus of Present-day Spoken English (DCPSE)*, a spoken, mainly British, English corpus. The corpus is comprised of two subcorpora, the *London–Lund Corpus (LLC)* and the *British*

mostly at the expense of present perfect and simple past tense forms. Closer analysis of the relevant contexts lets them conclude that there seems to be an "increasing tendency to choose the past non-perfect [i.e., simple past] in main clauses, relative clauses, and temporal clauses [where, historically, past perfect was used]" (Bowie et al., 2013). The observation that the simple past tense can convey readings that in earlier days were arguably only expressed by past perfects indicates that our more complicated past tense semantics is on the right track. In (17) we present some examples from Bowie et al. (2013) where the more transparent past perfect tense traditionally would have been used but now is not anymore.

(17) a. They sent one to my mother after she *died* or something.

b. *so I just took uh some of the tablets you* gave *me and it cleared up within two days* [Context indicates the giving of the tablets preceded their taking by as much as a year.]

3 Past tense in embedded and relative clauses

In this section, we show that our semantics renders a mechanism that explains the systematic ambiguity between the sim and the b-s readings of past-under-past embeddings without postulating past-tense meaning deletion. The crucial advantage of this approach over other syntactic-semantic approaches of SoT is that it does away with the assumption that the two readings are truth-conditionally distinct, an assumption which has recently been called into question by, e.g., Altshuler and Schwarzschild (2012); Altshuler (2016). In contrast to most of the literature (modulo Altshuler and Schwarzschild (2012); Altshuler (2016)), the proposal introduced here thus retains a one-to-one mapping between past tense form and meaning, a feature which makes it desirable from a compositional semantic point of view.

3.1 Main application

As a starting point for the analysis of sentences including more that one instance of past tense morphology, we follow Zeijlstra (2012), who proposes that the number of covert operators is regulated by economy principles: We assume that a covert operator (here *Op-PAST*) may only be included when grammatically necessary. Since a single covert past tense operator can in principle check off all of the uninterpretable past tense features in its syntactic domain via multiple agree—like any other covert operator—, a sentence with a both a past tense morpheme in the matrix and in an embedded clause in principle requires the presence of only one past tense operator. In (18), Zeijlstra's economy constraint thus entails that one *Op-PAST* will check all present [uPAST] features and no further *Op-PAST* may be included. Only when two [uPAST] features appear in different syntactic domains is the inclusion of a second *Op-PAST* allowed, and even necessary, as we will see later on.

The fact that only one past operator is required for the analysis of past-under-past constructions, together with the relative non-future semantics we attribute to past tense

Component of the International Corpus of English (ICE-GB), collected several decades apart, i.e., 1950s–1970s and 1990s, respectively, which enables the study of language change across this time interval (Bowie et al., 2013).

morphology, explains why every past tense embedded under another past tense is compatible with both a sim and a b-s reading: Such a configuration yields a totally ordered set of tense nodes from the matrix past operator to the most embedded past tense:[4]

(18) John said Mary was ill.

a. [*Op-PAST*$_{[\text{iPAST}]}$ [John [say-ed$_{[\text{uPAST}]}$ [Mary [be-ed$_{[\text{uPAST}]}$ ill.]]]]]
$\exists t' < t_u$ $\exists t^2 \leq t'$ $\exists t^3 \leq t^2$

b. $\exists t' < t_u$ & [$\exists t^2 \leq t'$ & say(John, t^2, [$\exists t^3 \leq t^2$ & be-ill(Mary, t^3)])]

c. *John's saying is strictly before the utterance time t_u and Mary's being ill starts out no later than at the time of John's saying.*

As was the case for mono-clausal sentences, the covert past tense operator in (18) places the sentence proposition at some time $t' < t_u$, providing the head of the tense chain. Both instances of past tense morphology are semantically taken to express a relative non-future with respect to their closest c-commanding tense node. The time t^2 is interpreted as a relative non-future with respect to t', and t^3 constitutes a relative non-future with respect to t^2. The b-s reading of (18) then arises in case that $t^3 < t^2$, while the sim interpretation is yielded for $t^3 = t^2$. The systematic availability of both readings for past-under-past constructions receives a principled explanation in terms of semantic underspecification and not in terms of LF-ambiguity in this way. Note that it also immediately follows that the f-s reading—in which t^3 would be temporally located between t^2 and t_u—cannot be derived. Our approach only takes every past tense morpheme to refer to a time interval no later that the closest c-commanding evaluation time.

3.2 Challenging complement clausal embeddings

The previous section has shown that our account yields the correct results for standard SoT sentences: It derives the sim and the b-s, but crucially not the f-s readings for past-under-past embeddings. At the same time, we have proven that the proposal makes correct predictions for mono-clausal past-tensed sentences. Nevertheless, it is received wisdom that any theory of SoT also has to account for more complex cases of temporal embeddings, e.g., cases in which an embedded past tense morpheme does receive a future-oriented interpretation or an interpretation that seems to be temporally independent from the closest evaluation time. This section and the next are devoted to demonstrating how our approach deals with such challenging SoT sentences. In this section, we explain the deviant behavior of past tense in complement clausal embeddings. In the following section, we explain the deviant behavior of past tense in (non-restrictive) relative clauses.

Future reference in past-under-past configurations involving *woll*

We begin with the well-established observation that—seemingly in contrast to what was said above—past-embedded past tense can in fact sometimes make reference to a time interval

[4]Note that for purposes of illustration we take *say* to be extensional here, though we are completely aware that it is an intensional predicate (see 5.1, as well as, e.g., (Pearson, 2015) and references therein)

that strictly succeeds the matrix time in English. Examples of such future-reference past tense uses include the following:

(19) John said he would buy a fish that was still alive. (Ogihara, 1989)

(20) He decided a week ago that in ten days he would say to his mother that they were having their last meal together. (Abusch, 1988)

In their most prominent readings, the most embedded past tense forms, i.e., *was* and *were*, express simultaneity with respect to their local evaluation times, i.e., the time of buying and the time of saying, respectively. The challenge such examples pose to SoT accounts stems from the fact that these local evaluation times have been shifted to a time later than the matrix time by means of *would* (cf., a.o., Abusch, 1988, 1997; Ogihara, 1989, 1995). As a result, *was* and *were*, even though carrying past tense morphology, receive a future-reference interpretation with respect to the matrix time.

Importantly, for temporal configurations as in (19) and (20) future-reference interpretations are possible, and the most prominent ones. Yet, in the absence of the temporal modifying adverbs, such as *still* in (19), the order of events is first and foremost underspecified. For example, without the temporal modifier *still*, sentence (19) could be felicitously uttered in case the fish is alive at the time of buying, in case it was alive shortly before the buying event but after the saying event, or arguably even in case it was alive prior to the saying event. Our approach successfully captures the multiple interpretations of such 'fish-sentences' under the assumption that *would* is the conflation of *woll*—a tense operator that places the evaluation time of a proposition in the relative future of the sentence's current evaluation time (cf. Abusch, 1988; Ogihara, 1996; Condoravdi, 2002) (cf. 21)— and a [uPAST] feature, which restricts its occurrence to past tense sentences.[5]

(21) $[\![\text{woll}]\!] = \lambda t.\ \lambda P.\ \exists t'.\ t' > t\ \&\ P(t')$

Under these assumptions, (19) receives the following interpretation:

(22) John said he would buy a fish that was alive.

a. [*Op-PAST*$_{[\text{iPAST}]}$ [John [say-ed$_{[\text{uPAST}]}$ [he [woll$_{[\text{uPAST}]}$ [buy a fish [that
$\exists t' < t_u$ $\exists t^2 \leq t'$ $\exists t^3 > t^2$
be-ed$_{[\text{uPAST}]}$ alive.]]]]]]]
$\exists t^4 \leq t^3$

b. $\exists x$ [fish(x) & $\exists t' < t_u.\ \exists t^2 \leq t'$: say(John, t^2, [$\exists t^3 > t^2$: buy(he, x, t^3) & $\exists t^4 \leq t^3$: be-alive(x, t^4)])]

c. *There is a time t^4 which is the time of a contextually salient fish's being alive, and t^4 is prior or equal to some time t^3. The time t^3 is the time of John's buying the fish which lies strictly after t^2, i.e., the time of John's saying event. t^2 is prior or equal to t' which, in turn, is a time strictly before the utterance time t_u.*

[5] Here, we ignore the modal contribution of the operator *woll* in terms of universal quantification over possible worlds (cf., e.g., Ippolito, 2013), which is orthogonal to the analysis presented in this paper.

What is essential about this analysis is that the most embedded past, i.e., *was*, is ordered prior or simultaneous to the time of the buying, and not prior or simultaneous to any other time, such as the matrix time or the utterance time. This correctly allows for a later-than-matrix interpretation of the embedded past tense, but does not necessarily entail a later-than-utterance time interpretation. The derived interpretation is, hence, compatible with all of the readings (19) may have. The same holds for example (20):

(23) He decided (a week ago) that (in ten days) he would say to his mother that they were having their last meal together.

a. [*Op-PAST*$_{[iPAST]}$ [He [decide-ed$_{[uPAST]}$ [he [woll$_{[uPAST]}$ [say to his mother [that
$\exists t' < t_u$ $\exists t^2 \leq t'$ $\exists t^3 > t^2$
they be-ed$_{[uPAST]}$ having their last meal together.]]]]]]]
$\exists t^4 \leq t^3$

b. $\exists t' < t_u$ & [$\exists t^2 \leq t'$ & decide(he, t^2, [$\exists t^3 > t^2$ & say-to-his-mother(he, t^3, [$\exists t^4 \leq t^3$ & be-having(they, last meal together, t^4)])])]

c. *There is a time t^4 which is the time of their last meal, and t^4 starts no later than some time t^3. The time t^3 is the time of his saying and lies strictly after t^2, i.e., the time of his deciding. t^2 is prior or equal to t' which, in turn, is a time strictly before the utterance time t_u.*

Even when neglecting the temporal modifiers, which unambiguously place the time of the meal in the future, the formula derived from the tense nodes within the sentence already shows that the time of the meal is not restricted to a past interval. As it is ordered relative to the f-s time of the saying event, the time of the meal can lie strictly after t_u. In fact, for (20), the b-s relation between the most embedded past tense and its c-commanding tense node (i.e., the time of saying) that our analysis predicts to be available is independently blocked due to additional aspectual information (i.e., imperfective aspect on *having*). Since disambiguation is achieved through aspect and not tense, however, such blocking does not provide a problem for the proposed analysis but rather shows how underspecification can be resolved in practice.

Future reference in past-under-past configurations without *woll*

Another set of challenging data which evokes a future interpretation for a past-embedded past tense in a complement sentence is comprised of sentences like the following:

(24) He hoped she tried to kill him first. (Klecha, 2016)

The novel challenge posed by these examples is that they have an interpretation akin to that of (19) and (20), even though they do not contain an overt future-shifter, like *woll*. Naturally, if you can still hope, you have not been killed yet, meaning that, temporally, the hoping event expressed in (24) takes place prior to the potential killing event. Klecha (2016) argues that the availability of such an independent future-shifted interpretation of the embedded past tense is restricted to predicates that already have an inherent modal future orientation built into their semantics, like *hope* or *pray*. By contrast, Klecha proposes that predicates like

think impose an upper limit on the temporal possibilities of their prejacents and therefore the temporal possibilities of their complement clauses, as they cannot themselves introduce a similar future-shifted interpretation in the absence of another modal (cf. Abusch's ULC, Section 5).

Klecha's (2016) implementation of this insight relies on the observation that future-oriented attitudes like *hope* deviate from other, non-future-oriented attitudes like *think*, in the choice of modal base pronouns they may combine with. Modal bases are known to determine the set of worlds which are accessible from a given point in time (Kratzer, 1981, 1991), and Klecha (2016) claims that only two different modal bases exist: a doxastic one, which imposes an upper limit on its prejacent's temporal orientation via quantifying over *actual* histories, and a circumstantial one, which does not impose such a limit and instead maps the prejacent's time and a history to the set of all possible *future* histories departing from that time. Crucially, Klecha argues that attitude verbs like *think* may only combine with a doxastic modal base, whereas *hope* and *pray* may also combine with a circumstantial modal base, explaining the possible f-s interpretations of their complement clauses.

Klecha's view is in full accordance with our proposal. Although the past tense morphology on *hope* in (24) places the time of the matrix sentence prior to the utterance time, as a future-oriented predicate *hope*, by itself, can shift the evaluation time of its complement proposition to a future point in time—even in the absence of *woll*.

(25) He hoped she tried to kill him first.

a. [*Op-PAST*$_{\text{[iPAST]}}$ [He [hope -ed$_{\text{[uPAST]}}$ [she try-ed$_{\text{[uPAST]}}$ [to kill him first]]]]]
   $\exists t' < t_u$ $\exists t^3 \geq t^2$ $\exists t^2 \leq t'$ $\exists t^4 \leq t^3$

In our proposal, this inherent future-orientation of *hope* and *pray* is hard-wired into their semantics. Note that we are not dependent on this implementation of Klecha's proposal; Any type of inherent future semantics as part of the lexical meaning of such predicates, be it via modal bases or otherwise, can derive these facts under our analysis.

As a result of the inherent future shift, our analysis derives the correct meaning of such future-shifted sentences *mutatis mutandis* to (19) and (20): Since the forward-shifted evaluation time t^3 is introduced in the matrix clause (which can lie strictly after the time of utterance t_u), the verb *tried* then simply means *tried at time* t^4, whereby t^4 is no later than t^3 and can also lie in the strict future of t_u. One caveat of the implementation we choose is that we also predict an unattested reading of (24) to be available, i.e., one in which the killing takes place prior to the hoping (e.g., in the case that $t^4 < t^3 = t^2 = t' < t_u$). Whereas the availability of such a temporal ordering is crucial for us in order to derive the correct semantics for sentences like (26), which Klecha (2016) would solve via a different modal base, for the case under discussion we have to rely on pragmatics, e.g., the addressee's knowledge that hoping requires not having been killed yet, to independently block such readings.

(26) John hoped (at 4pm) she got there on time (at 3pm).

Future reference in past-under-future configurations

The last instance of embedded past tense morphology receiving a future interpretation we discuss in this paper concerns cases where past tense is embedded under a future matrix predicate (cf. (27)). Such past-under-future constructions again give rise to different readings: In some, the past tense is assigned its canonical 'prior to time of utterance'-interpretation (cf. (27a)). Crucially, however, in the most prominent reading of (27), the past-marked predicate takes place after the utterance time (cf. (27b))—a reading which poses a challenge to most SoT theories.

(27) Alan will think everyone hid.
   a. (Tomorrow) Alan will think everyone hid (yesterday).
   b. (Tomorrow at 3pm) Alan will think everyone hid (tomorrow at 2pm).

An important observation that can be made with respect to the analysis of such sentences is that the tense shifter *woll* is instantiated as *will* in this context. As a result, it becomes evident that *Op-PAST* cannot take higher scope than the *woll*, as otherwise it would be spelled out as *would*. This immediately entails that *will* cannot carry a [uPAST] feature. As part of his economy principle, Zeijlstra (2012) proposes that an operator needs to be included in the closest possible position above the highest instance of the uninterpretable feature it checks. Since *will* does not carry a [uPAST] feature *Op-PAST* could check (but rather a feature [uPRES], see Section 4), the operator is included above the highest instance of [uPAST], i.e., in the complement clause. As a result, the underlying syntactic structure of (27), for now, must be the following (cf. also Heim, 1994):

(28) [Alan will think [$\textit{Op-PAST}_{[\text{iPAST}]}$ [everyone hide-$\text{ed}_{[\text{uPAST}]}$]]]

Uncontroversially, we take the semantics of *will* to be the same as those for *would* (cf. (21)), modulo the [uPAST] feature, which restricts it to past environments. Hence, *will* shifts the local evaluation time of its prejacent to a point in time which succeeds the evaluation time it receives as its input. Sentence (27) does not specify a local evaluation time for *woll*'s relative parameter t, e.g., by means of a modifying clause or an embedding predicate; The variable thus gets valued against its default value t_u. Under these assumptions, the correct interpretation of (27) is yielded in the following way:

(29) Alan will think everyone hid.
   a. [Alan will think [$\textit{Op-PAST}_{[\text{iPAST}]}$ [everyone hide-$\text{ed}_{[\text{uPAST}]}$]]]
      $\exists t' > t_u$ $\exists t^2 < t'$ $\exists t^3 \leq t^2$
   b. $\exists t' > t_u$ & think(Alan, t', [$\exists t^2 < t'$ & $\exists t^3 \leq t^2$ & hide(everyone, t^3)])
   c. *There is a time t' in the strict future of t_u and Alan thinks at t' that there is a time t^2 earlier than t' such that everyone from a contextually salient group hid at a point t^3 no later than t^2.*

The evaluation-time shifter *will* takes scope over the past tense operator and changes the local evaluation time t^* of *Op-PAST* to a time in the future. It is from this future-shifted

point in time that the past marker *-ed* introduces a no-later-than relation between the hiding event and the thinking event; no direct connection between the event time of the past-tensed predicate and t_u is thus established, which is why the hiding can lie in the strict future of t_u.

Note that if the operator *Op-PAST* entailed an absolute past ordering of the tense morphemes it takes scope over with respect to the utterance time (i.e., if its denotation were $[\![\ \textit{Op-PAST}\ ]\!] = \lambda P.\ \exists t < \underline{t_u}\ \&\ P(t)$), sentences such as (27) could not be accounted for by our proposal. However, as seen in (13), the relation 'prior to time of utterance' is not cooked into the semantics of *Op-PAST*; Instead, the operator is defined as a *relative* past with respect to a time variable t^*, whose value may be t_u, but which can also refer to a time interval later than t_u, if introduced by an independent source.

3.3 Relative clauses

A further set of data for which embedded past tense morphology may evoke readings that are not anchored with respect to the local evaluation time involves relative clauses. In certain relative clauses, as in example (30), the embedded past can yield any of the following readings: a b-s, a sim and a f-s one. Both past tenses independently refer to a time interval prior to the time of utterance.

(30) Mary met a woman who was president.
   a. In 2000, Mary met a woman who was president in 1995. [b-s]
   b. In 2000, Mary met a woman who was president in 2000. [sim]
   c. In 2000, Mary met a woman who was president in 2004. [f-s]

However, this is not the case for every relative clause. In (31) (under neutral intonation) the f-s reading is not available (Heim, 1994; Ogihara, 1995; Stowell, 2007):

(31) Mary was looking for a woman who *was* president. [b-s]
   a. In 2000, Mary was looking for a woman who was president in 1995. [sim]
   b. In 2000, Mary was looking for a woman who was president in 2000.
   c. * In 2000, Mary was looking for a woman who was president in 2004. [f-s]

Whereas Enç (1987) observed that relative clause tenses differ from complement clause tenses in allowing an independent, or absolute interpretation, Abusch (1988) showed that this only applies to relative clauses that receive a *de re* interpretation (see also Ogihara, 1989, 1996). Indeed in (30), only a *de re* reading is available. In (31), a *de dicto* reading is available.

The *de re*/*de dicto* distinction is strongly connected to the distinction between restrictive and non-restrictive (or appositive) relative clauses, as can also be witnessed in the above examples: (30) contains a non-restrictive, *de re*-interpreted relative clause. By contrast, under the triggered *de dicto* reading, the relative clause in (31) is understood to be restrictive. Non-restrictive relative clauses only allow *de re* interpretations. As is also well known, restrictive and non-restrictive relative clauses behave differently with respect to syntactic locality. Whereas non-restrictive relative clauses are syntactically opaque (cf. Safir,

1986; Fabb, 1990; Demirdache, 1991; Borsley, 1992; Arnold, 2007, for different accounts for the locality effects of non-restrictive relative clauses), restrictive relative clauses are more accessible. The fact that different types of relative clauses allow for different readings with respect to the availability of f-s readings opens up a way to think about the availability of the f-s reading in terms of syntactic locality.

In this, we follow Stowell (2007) who argues that the *de dicto*/*de re* distinction is structurally encoded in terms of the LF position of the relative clause: outside or inside the CP complement of the intensional verb. Concretely, we entertain the hypothesis (in line with Stowell (2007), though also substantially different from it) that the past tense morpheme inside a relative clause that yields a *de dicto* reading can have its [uPAST] feature checked against a higher covert tense operator carrying [iPAST], but that the past tense morpheme inside a relative clause that yields a *de re* interpretation cannot do so. Consequently, the latter requires a covert past tense operator of its own, with t^* being valued for the time of utterance. Therefore, a relative clause with a *de dicto* interpretation allows only a sim and a b-s reading (when containing past tense morphology embedded by a higher past tense clause), whereas a relative clause with a *de re* interpretation in the same situation yields sim, b-s, and f-s readings.

This explains why the two past tense markers in (30) and (32) need to be evaluated independently of each other with respect to the time of utterance: Given the syntactic opacity of the non-restrictive relative clause, the [uPAST] feature on the past tense morpheme inside the relative clause cannot be checked by the covert past tense operator that the matrix past tense morpheme agrees with. Consequently, a second, lower *Op-PAST* must be included. As this lower operator in (32) cannot be bound by any higher tense, both past tense operators refer to the time of utterance (Zeijlstra, 2012).

(32) Mary met a woman who was president.

a. [*Op-PAST*$_{\text{[iPAST]}}$ [Mary meet-ed$_{\text{[uPAST]}}$ a woman [who [*Op-PAST*$_{\text{[iPAST]}}$ [
$\exists t' < t_u$ $\exists t^2 \leq t'$ $\exists t'' < t_u$
be-ed$_{\text{[uPAST]}}$ president]]]]]
$\exists t^3 \leq t''$

b. $\exists x$ [woman(x) & $\exists t' < t_u$. $\exists t^2 \leq t'$ [meet(Mary, x, t^2) & $\exists t'' < t_u$. $\exists t^3 \leq t''$ [president(x, t^3)]]]

c. *There is a woman x and at t^2, prior or equal to t' which, in turn, is a time strictly before the utterance time t_u, Mary met x, and at t^3, prior or equal to t'' which, in turn, is a time strictly before the utterance time t_u, x is president.*

The relative clause in (31) and (33), which is not syntactically opaque and for which agreement inside of the relative clause is therefore possible, yields a temporal interpretation that is similar to that of complement clauses of intensional verbs. The most embedded past tense is ordered with respect to the matrix tense and cannot independently be placed prior to the utterance time:

(33) Mary was looking for a woman who was president.

a. [*Op-PAST*$_{[\text{iPAST}]}$ $\exists t' < t_u$ [Mary be-ed$_{[\text{uPAST}]}$ $\exists t^2 \leq t'$ looking for a woman [who [be-ed$_{[\text{uPAST}]}$ $\exists t^3 \leq t^2$ president]]]]

b. $\exists t' < t_u$. $\exists t^2 \leq t'$ [be-looking-for(Mary, t^2, [$\exists t^3 \leq t^2$. $\exists x$ [woman(x) & be-president(x, t^3)]])]

c. *At t^2, prior or equal to t' which, in turn, is a time strictly before the utterance time t_u, Mary is looking for a woman x, and at t^3, prior or equal to t^2, x is president.*

Hence, the behavior of past tense in relative clauses is fully compatible with our proposal.

3.4 Comparison with other SoT approaches

So far in this section we have introduced an alternative account of SoT that relies on underspecified tense semantics instead of ambiguity at the level of LF, and we showed that it fares at least equally well with respect to the different challenges English poses to SoT accounts as existing proposals. Nevertheless, the fact that our account can explain the data does not in itself justify its correctness. Given the impressive canon of SoT literature, an important question to answer is how the proposal compares to existing ones and whether it provides new insights or even advantages.

Comparing underspecification- and ambiguity approaches

When comparing our analysis to existing ambiguity SoT approaches, an immediate advantage that emerges on the theoretical side is that we do not have to postulate a difference between a real past and a surface past, which is, in fact, a present tense in disguise (cf., e.g., Abusch, 1988; Ogihara, 1989), a zero tense (cf. Kratzer, 1998), or something yet different. In order to account for the simultaneous reading of past-embedded past tense, most ambiguity analyses are forced to allow present tense morphemes to receive the morphological shape of a past tense morpheme under certain conditions, an assumption which is primarily stipulated (c.f., e.g. Abusch, 1988; Ogihara, 1989; Kusumoto, 1999; Stowell, 2007, and references therein), except for by Kratzer (1998), who embeds the assumption into the bigger picture of binding theory, where anaphors denote bound variables that inherit features of their antecedents at PF.

Via taking past tense morphology to be a relative non-future, the approach proposed in this paper can account for the same cases as the ambiguity proposals while retaining a clear one-to-one mapping between temporal form and temporal meaning. Similar concerns along the same lines arise for ambiguity proposals in light of the questions of why only past tense exhibits the proposed kind of ambiguity—and not present tense, too—, and why this putative homophony is a systematic, cross-linguistic phenomenon (see Stowell (2007) for further discussion).

In addition, empirically, advantages of our proposal reveal themselves in ellipsis configurations such as (34a), which are known to tease apart ambiguity and underspecification

readings, or in conclusion sentences with coordinated subjects as given in (34b).

(34) SCENARIO. At breakfast (earlier this morning), John said "Mary was ill a month ago," and Bill said "Mary is ill now."

a. During breakfast, John said that Mary was ill and Bill did so, too.

b. Therefore, during breakfast, both John and Bill said that Mary was ill (at some point).

Given the assumption of structural parallelism in ellipsis contexts, ambiguity approaches predict that (34a) may only be used in scenarios in which John and Bill both uttered the sentence *Mary is ill* or both uttered the sentence *Mary was ill*. This is because the LF of the elided clause must be identical to the LF in the antecedent (cf. 34a). Since sim and b-s readings have different LFs in these approaches, the two readings should be the same for both clauses; They should both either yield a sim reading or a b-s reading. As a result, ambiguity approaches predict sentence (34a) to be infeasible in the given scenario. Similarly, ambiguity approaches rule out the coordinated subject construction in (34b) as an adequate conclusion sentence in the provided context, since there exists a mismatch between the simultaneous report context set up by John's utterance and the backward-shifted one set up by Bill's utterance. Our proposal, on the other hand, rules it in as an adequate conclusion. We predict temporally mixed readings to be available for both (34a) and (34b) (of course, in addition to the temporally parallel ones). Hence, under the approach proposed in this paper, (34a) and (34b) are acceptable.

Indeed, it appears that mixed readings such as in (34a) are available. Most of our informants have furthermore accepted sentences with coordinated subjects in scenarios such as (34b), albeit native English speakers prefer (34) less without the modifier *at some point*. All informants so far across the board accepted the sentence with *at some point* in it. It is not straightforwardly clear how ambiguity approaches would explain this data.

The empirical predictions that the underspecification approach makes appear to be correct indeed. Given the theoretical and empirical advantages underspecification analyses exhibit over ambiguity approaches, we therefore reject the hypothesis that SoT should best be explained in terms of LF ambiguity. Note that we are not the first ones to take a stand against this well-established ambiguity assumption, though. Altshuler's (2016) and Altshuler and Schwarzschild's (2012) pragmatic SoT proposal also assigns only one LF to both readings. As a next step, we shall evaluate our analysis against theirs.

Comparison with existing non-ambiguity approaches

Like us, Altshuler (2016) and Altshuler and Schwarzschild (2012) assume that past-under-past embeddings of stative predicates are not ambiguous between a sim and a b-s reading. Unlike us, however, they propose that such configurations always, unambiguously, receive a b-s interpretation and that a true sim reading of past-embedded past tense does not exist. In fact, what is commonly referred to as the simultaneous reading of embedded past tense in the SoT literature for them only constitutes a canonical past reading that does not stand in competition with the present-tensed alternative of the same clause. Thanks to the lack

of competition, they argue, such instances of past-tensed statives do not evoke their usual cessation implicature that the described state no longer holds, and therefore the perception of simultaneity arises.

To make the theory's core assumption more explicit, consider the following example.

(35) My heart was racing.

Even though nothing in the semantics of the sentence excludes the possibility that the author's heart is still racing at the time of utterance (under an existential theory of tense, the truth conditions of (35) are met as long as there exists some moment prior to t_u at which the author's heart was racing), we nevertheless understand that the described state no longer holds. According to Altshuler's (2016) and Altshuler and Schwarzschild's (2012) scalar theory of tense, this is the case since the utterance stands in Gricean competition with its present-tensed alternative *My heart is racing.* The present-tensed version of the clause hereby provides a suitable competitor for its past-tensed counterpart since the temporal profile of statives and stative-like predicates is conjectured to be such that whenever a state holds at a point in time, it must necessarily also hold at another point in time, no matter how tiny, which precedes it (Altshuler, 2016; Altshuler & Schwarzschild, 2012). Thus, whenever a state holds at the time of utterance, it must also have held at a moment prior to it, meaning that a present-tensed stative always asymmetrically entails its past-tensed counterpart (referred to as the *Temporal Profile of Statives (TPS)* in Altshuler (2016) and Altshuler and Schwarzschild (2012)). Assuming that the speaker in (35) is cooperative, i.e., maximally informative, it follows that she would have used the stronger, present-tensed version of the sentence would the state still hold (Grice, 1975). Since she decided to use a past tense, however, the addressee is encouraged to compute a *cessation* implicature, i.e., the implicature that no state of the kind described by the clause (here: the speaker's heart racing) is currently in existence (Altshuler & Schwarzschild, 2012; Altshuler, 2016).

Given such assumptions, now the question that arises for the scalar tense theory is why past tense morphology does not evoke cessation implicatures uniformly. For example, they have to explain why no cessation implicature is commonly calculated in the following sentence.

(36) The doctor said my heart was racing.

As before, the answer lies in the clause's competition with its present-tensed alternative, i.e., *The doctor said my heart is racing.* As it turns out, this alternative cannot function as a competitor for (36), given the fact that it yields a d-a reading, and it is exactly in those cases in which it cannot do so that Gricean reasoning does not advance to the stage at which a cessation implicature is drawn and the sentence, even though backward-shifted in semantic terms, is perceived to convey simultaneity.

Even though our proposal makes similar predictions as Altshuler (2016) and Altshuler and Schwarzschild's (2012) with respect to the non-ambiguity of different past-under-past readings, it is also substantially different. For the scalar theory, for example, the TPS is a necessary assumption for the computation of a cessation implicature, as it places the present- and past-tensed version of stative clauses on a scale. At the same time, the TPS is

not uncontroversial. It has been (implicitly) rejected in various existing semantic discussions of tense (cf., e.g., the discussion of lifetime effects in Musan (1997); Magri (2009, 2011); Thomas (2012) or the *earliest*-operator in Beaver and Condoravdi (2003)). Crucially, our approach does not rely on this assumption.

Nevertheless, even if we were to accept the TPS hypothesis, Altshuler (2016) and Altshuler and Schwarzschild's (2012) proposal would make different predictions from ours. Their proposal predicts that past-under-past embedded eventive predicates are always interpreted in a b-s and not a sim manner (as the TPS does not hold for eventives). Our proposal, by contrast, should allow for sim and b-s readings for both embedded eventive and embedded stative predicates—similar to many versions of the classical ambiguity theory, which also do not have stativity as a prerequisite for sim readings. A possible point of evaluation between the two non-ambiguity proposals is therefore provided by the presence or absence of simultaneous readings of past-embedded eventive predicates. We believe that our proposal is indeed on the right track as the claim that no embedded past eventive may receive a sim interpretation appears to be too strong for English.

That only stative predicates may receive a sim interpretation has, for example, been refuted by Kusumoto (1999). She argues, with Partee (p.c. to Kusumoto, as cited in Khomitsevich (2007)), that examples such as (37) has a sim reading even though it embeds a past eventive verb:

(37) Elliott observed/noticed/perceived that Josephine got hurt.

(Kusumoto, 1999)

Simultaneous readings generally appear to be possible for verbs of perception (*observe/notice/perceive*), even though for some speakers a b-s reading is still preferred. We take this to be due to the fact in English, where there exists a grammaticalized imperfective-perfective distinction, the usage of perfective aspect in past-under-past constructions yields a preference for a b-s reading. This is because the imperfective grammatical competitor (i.e., *Elliott observed that Josephine was getting hurt*) or infinitival competitor (i.e., *Elliott observed Josephine getting hurt*) unambiguously triggers a sim reading due to its stativity property, and thus provides a more transparent way to express the desired reading. The fact that there exist such (aspectual) competitors in English, however, suggests that the absence of the sim reading in English past-under-past perfectives must be due to pragmatic blocking effects rather than being a property of past itself. The question then is why the sim reading under perception verb is less sensitive to these pragmatic effects than other verbs. We presume that this has to do with the lexical semantics of perception verbs (in general, you perceive something at the time it is happening). However, irrespective of the question why certain verbs appear to be more sensitive to these blocking effects than under other verbs, the crucial thing is that since simultaneous readings are possible for eventive predicates, tense semantics must in principle allow for them and not forbid them (as is in Altshuler (2016)'s and Altshuler and Schwarzschild's (2012) system).[6]

[6] In addition to its reliance on stativity and, thus the different empirical coverage of the proposal put forth in this paper and scalar theories, there are (at least) two other key assumptions of the latter which have recently been called into question (see Sharvit, 2018, for an in-depth discussion): The first is that it proposes

All in all, this section has shown that the SoT approach proposed here not only explains the relevant data points of embedded tense in English but also has clear advantages over alternative existing SoT analyses.

4 Extending the proposal to present tense

As has been stated in the introduction, even though the alleged ambiguity of embedded past tense morphology has received a lot of attention in the literature, the present tense morphology puzzle seems to have been discussed less extensively so far. Nevertheless, we argue in this section that they can be analyzed on a par. Such a unified treatment of past- and present tense morphology will be able to capture both of the tenses' undergeneralized meaning and thus incorporate an absolute as well as a relative meaning component. The proposal laid out in the previous section, which disentangles the different meaning components of the past tense via outsourcing its 'real' past meaning, i.e., anteriority, into a high, covert past operator (*Op-PAST*) while encoding its relative past meaning, i.e., non-future, into the actual past tense morpheme (*-ed*), is compatible with this objective. In this section, we show that a similar mechanism can also account for the behavior of embedded present tense.

We start our discussion of present tense morphology with a reminder of the conundrum it poses across different embedding contexts. For this, reconsider the sentences in (8), repeated for convenience in (38):

(38) a. John will say Mary is ill. [sim]
b. John said Mary is ill. [d-a]

The crucial observation is that the present tense morphology on *is* has a different meaning effect in the two sentences: In (38a) it evokes a simultaneous (sim) reading, meaning that it expresses simultaneity solely with respect to its local evaluation time, i.e., the time of John's saying. Sentence (38a) can thus be felicitously paraphrased as follows: *John, at some t later than t_u: "Mary is ill (now)."* In (38b), by contrast, the present tense receives a double-access (d-a) reading: It is understood to express simultaneity with respect to both the utterance time and the local evaluation time, i.e., the time of John's saying. As a result, (38b) is true if and only if both *Mary is ill at t_u* and *Mary is ill at some t prior to t_u, whereby t denotes the time of John's saying event.* These embedding environments reveal that, just like past tense morphology, present tense morphology must also be underspecified in meaning.

In order to explain the observed behavior of present tense morphology, we propose a strategy along the lines of our proposal for past tense. We assume that present tense, too,

that no SoT-rule (i.e., present-in-disguise, zero tense, etc) is needed since the absence of cessation can derive the sim reading. This assumption, however, is called into question by languages such as Hebrew and Greek, in which the 'fish'-sentences (see Section 1.1) can be expressed both via an embedded present and via an embedded past tense. Scalar theories then have to explain why cessation is optional in a context in which is usually applies—a concern which, self-evidently, does not carry over to our proposal. Secondly, a scalar theory of SoT assumes a correlation between non-cessation and sim readings, an assumption which has been recently refuted on the basis of unambiguously backward-shifted sentences which include past modification like *two minutes ago* and/or past perfect morphology. Since we do not assume a similar correlation, this concern, too, does not carry over to the current proposal.

consists of two ingredients: a covert present tense operator and a semantically active present tense morpheme that agrees with this operator. It was shown in Section 2 that past tense takes scope outside *vP*, evidencing that (past) tense is not interpreted in the base position of the past tense morpheme. As a result we assume also for present tense that, syntactically, each present tense morpheme carries an uninterpretable present feature [uPRES] to be checked by a covert present tense operator (*Op-PRES*) carrying the interpretable feature [iPRES]. Semantically, we make the following assumptions for the two ingredients. First, similar to our proposal for past tense morphology, each instance of present tense morphology (denoted for convenience by *-s* in the following) encodes simultaneity with respect to its respective local evaluation time and thus functions as a relative meaning component of present tense. Simultaneity is hereby encoded in terms of time interval inclusion (where $t' \supseteq t$ means that the time interval t is included in or equal to t'):

(39) $[\![\text{-}s]\!] = \lambda t.\ \lambda P.\ \exists t'.\ t' \supseteq t\ \&\ P(t')$

Second, different from our account of past tense, but following ideas from Heim (1994) and Altshuler (2016), we propose that the high, covert present tense operator (*Op-PRES*), which encodes the 'real' present tense meaning, fulfills a *dual* role: It establishes an inclusion relation with respect to both its local evaluation time, t^*, and the utterance time t_u. Accordingly, we take its denotation to be as follows:

(40) $[\![\textit{Op-PRES}]\!] = \lambda t^*.\ \lambda P.\ \exists t'.\ [\ t' \supseteq t^*\ \&\ t' \supseteq t_u]\ \&\ P(t')$

As was the case with past tense, at matrix level t^* applies to t_u by default. If this applies (as, e.g., in (42) and (44)), then the two tense restrictions *Op-PRES* introduces coincide and simplify to a purely absolute semantics of the operator:

(41)
$$\begin{aligned} [\![\textit{Op-PRES}]\!](t_u) &= \lambda P.\ \exists t'.\ [\ \underline{t' \supseteq t_u\ \&\ t' \supseteq t_u}]\ \&\ P(t') \\ &= \lambda P.\ \exists t'.\ t' \supseteq t_u\ \&\ P(t') \end{aligned}$$

Based on these assumptions, we predict a simple present-tensed sentence like (42), which places an event unambiguously at the utterance time, to have the following interpretation:

(42) John is running.

a. [*Op-PRES*$_{\text{[iPRES]}}$ John [be-s$_{\text{[uPRES]}}$ running]]
   $\exists t'.\ [\ t' \supseteq t_u\ \&\ t' \supseteq t_u]$ $\exists t^2 \supseteq t'$

b. $\exists t' \supseteq t_u\ \&\ [\ \exists t^2 \supseteq t'\ \&$ be-running(John, t^2)]

c. *The utterance time t_u is included in a time t', which is included in the time of John's running (which entails that the utterance time t_u is in the time of John's running).*

From the example in (42) it becomes evident that our proposal of present-tense meaning, derives the correct semantics for mono-clausal present tense sentences. Moreover, and here we essentially build up on insights by Heim (1994); Altshuler (2016)), this semantics predicts the facts observed in (38), as they interact differently with different embedding environments. To see this, let us first consider a context in which present tense morphology is embedded under a future-tensed matrix predicate (cf. (38a)).

From our discussion of the future-embedded past tensed sentence in (27), i.e., *John said everyone hid*, we know that the shifter *will* does not carry a [uPAST] feature and that it must occur outside of the domain of *Op-PAST* as a result. In fact, we assume—similarly as we did for *would* (cf. discussion surrounding (21))—and in line with many others (e.g., Abusch, 1988; Ogihara, 1996; Condoravdi, 2002) that *will* is the tenseless future-shifting operator *woll* (cf. (43)) in its present-tensed form, meaning that it carries a [uPRES] feature. Consequently, it must be checked by *Op-PRES*.

(43) $[\![\text{woll}]\!] = \lambda t.\ \lambda P.\ \exists t'.\ t' > t\ \&\ P(t')$

Furthermore, we follow Zeijlstra (2012) in that the covert operator carrying [iPRES] must c-command the highest instance of [uPRES] at the lowest position where this is syntactically and semantically possible (cf. Section 3). Consequently, *Op-PRES* must take scope over *will* in (38a), leading to the operator's being valued against t_u again, and turning it into a purely absolute operator (as in (42)). Hence, in future-embedded environments, the dual effect of *Op-PRES* remains invisible:

(44) John will say Mary is ill.

a. [*Op-PRES*$_{[\text{iPRES}]}$ [John [woll$_{[\text{uPRES}]}$ say [Mary [be-s$_{[\text{uPRES}]}$ ill]]]]]
   $\exists t' \supseteq t_u$ $\exists t^2 > t'$ $\exists t^3 \supseteq t^2$

b. $\exists t' \supseteq t_u$ & [$\exists t^2 > t'$ say(John, t^2, [$\exists t^3 \supseteq t^2$ & be-ill(Mary, t^3)])]

c. *John's saying happens strictly after the utterance time t_u and time of John's saying is included in the time of Mary's pregnancy.*

The dual nature of the present tense operator does reveal itself, however, in present-under-past embeddings, though, where it explains the double-access reading observed in (cf. (38b)). Here, Zeijlstra's (2012) economy constraint places *Op-PRES* in the embedded clause, resulting in *Op-PRES*'s relative tense parameter's being valued against the local evaluation time provided by the matrix past tense morpheme. As a result, our proposal, correctly, predicts present-under-past embeddings to have d-a readings:

(45) John said Mary is ill.

a. [*Op-PAST*$_{[\text{iPAST}]}$ [John [say-ed$_{[\text{uPAST}]}$ [*Op-PRES*$_{[\text{iPRES}]}$ [Mary [be-s$_{[\text{uPRES}]}$
   $\exists t' < t_u$ $\exists t^2 \leq t'$ $\exists t''.[t'' \supseteq t^2\ \&\ t'' \supseteq t_u]$ $\exists t^3 \supseteq t''$
   ill]]]]]]

b. $\exists t' < t_u$ & [$\exists t^2 \leq t'$ & say(John, t^2, [$\exists t''$. [$t'' \supseteq t^2$ & $t'' \supseteq t_u$] & [$\exists t^3 \supseteq t''$ & be-ill(Mary, t^3)]]]]

c. *John's saying happens strictly before the utterance time t_u and both the time of saying and the time of utterance are included in the time of Mary's pregnancy.*

In sum, our approach systematically assigns either a sim or a d-a reading to embedded present tense morphology, while keeping the intuitive meaning of unembedded present tense intact. It assigns embedded present tense a sim reading when the matrix clause is headed by an *Op-PRES* operator, i.e., in present or future embeddings, and it assigns present tense a d-a reading when it is embedded in an *Op-PAST*-headed clause.

Even though such a proposal makes the correct predictions, one might wonder why, at least in the case of matrix present tense, the time of utterance is introduced into the semantics twice, via two different mechanisms, i.e., once via being encoded in the semantics of *Op-PRES* and once as a default variable for the highest temporal argument slot. But, as said before, here we follow Heim (1994) and Altshuler (2016), who have provided various arguments for the inherent dual nature of present tense semantics. Naturally, it remains an open question why present tense should have such a dual nature in the first place. Why wouldn't it only make reference to the time of utterance instead of both the time of utterance and the local evaluation time? This is a question that lacks an intuitive answer, at least for us, but indeed the different types of readings attested with present tense morphology directly follow from this dual nature.

5 Capturing our proposal in pronominal terms

In this section, we show that the semantic contributions of present and past tense that we propose can be straightforwardly implemented in pronominal terms, as well. Since the proposed analysis does not rely on distinct LFs for the derivation of the deviating readings of embedded tense morphology, we show that embedded tense effects can be explained without the assumption of additional machinery, such as *res*-movement or concept-generators.

Embedded tense phenomena have historically played an important role in distinguishing between the two main approaches to tense semantics, i.e., *quantificational* analyses in the spirit of Prior (1967), which assume that tense introduces existential quantification over points in time, thereby relating the predicate's (P) event time (t') to its evaluation time (t) in a specific way (e.g., for past tense: $[\![\,[\text{PAST P}]\,]\!]^t = \exists t'.\ t' < t\ \&\ P(t')$), and *pronominal* approaches in the spirit of Partee (1973), which propose that tense is pronominal in nature and imposes presuppositional restrictions on its referents (e.g., for past tense: $[\![\,[\text{PAST}_i\ \text{P}]\,]\!]^{g,t} = P(g(i))$, defined if and only if $g(i) < t$). Nowadays, the debate of whether tense phenomena support a pronominal or a quantificational view of has been mostly resolved, primarily due to the proposal of contextual restrictions coupled with the quantificational force in a quantificational analysis or default existential operators that bind pronominal tenses, which explain the empirical data presented in the literature in favor either view of tense under the respective other, as well (Ogihara (1989, 1995); von Stechow (2002, 2009); Musan (1997); Kusumoto (1999, 2005); though see Heim (2015)).

Nevertheless, embedded tense phenomena remain challenging in the sense that they force pronominal approaches (and for d-a cases, arguably, also quantificational approaches (see, e.g. Bar-Lev, 2014, for discussion)) to adopt additional technical machinery: While the sim reading of embedded past tense morphology can be derived fairly straightforwardly under referential tense semantics—by postulating some rule that allows the embedded tense pronoun to be interpreted as a bound variable and to inherit its morphological features from the matrix tense (cf. Heim, 1994; Abusch, 1997; Kratzer, 1998; von Stechow, 2009)—the b-s reading is not derived as easily. This is because, just as the matrix past tense, the embedded past tense is assumed to carry referential semantics, which can only be licensed in attitude contexts if the tense is interpreted *de re* (cf., e.g., Kratzer, 1998). For the embedded past

tense to be interpreted *de re*, there must exist some kind of mechanism that allows it to move outside the scope of the attitude verb.

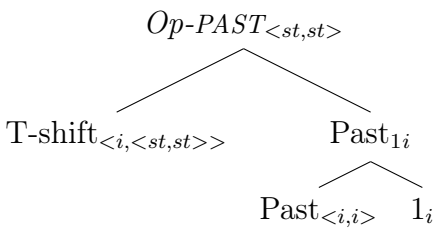
To the best of our knowledge, two successful implementations of such a mechanism exist, but both of them are not trivial in the sense that they have to assume additional technical machinery. As a standard, pronominal approaches allude to *res-movement* in order to derive the b-s reading (Heim, 1994; Abusch, 1997). The *res* tense is hereby moved outside of the embedding predicate's scope to an extra argument position of the verb, making it viable to be interpreted with respect to the time of utterance. Even though this rescue strategy is commonly applied, shortcomings of this operation—e.g., res-movement is from an A-bar position to an A-position, does not leave a trace, and requires you to have a relational meaning for the attitude predicate in addition to the 'regular' one—have been long acknowledged in the literature (Heim, 1994) and further discussed since (cf., e.g. Percus & Sauerland, 2003; Cable, 2015), casting doubt on the legitimacy of this operation. An alternative is to introduce *concept generators* into the semantics, i.e., argued to be independently motivated for the analysis of other directly referential expressions in attitude contexts, such as proper names (cf., e.g. Percus & Sauerland, 2003). In addition to the technical assumptions each rescue mechanism strategy requires, they furthermore rely on some implementation of Abusch's Upper Limit Constraint (ULC) in order to exclude the f-s reading two independently indexical past tenses create. The ULC states that the event time of the matrix clause provides an upper bound for the reference time of the embedded clause (Abusch, 1997; Heim, 1994, a.o.), prohibiting any reading in which the embedded event occurs later than the matrix event

In summary, there exist two general ways to explain embedded tense phenomena under a pronominal tense semantics so far: one involves the assumption of a principle like res-movement, the other one the assumption concept generators. Whether such additional machinery is independently needed is orthogonal to the argument of the paper. What we argue in this section, however, is that the need to allude to additional machinery for explaining these readings emerges by virtue of assuming that the different readings embedded tense gives rise to are the result of two different interpretations of past/present tense morphology and thus two different LFs for each. We do so by showing that an *underspecification approach*, in which there is no independent b-s/d-a reading, does not require any additional machinery.

5.1 Pronominal past tense

For the pronominalized version of our underspecification approach, we take *Op-PAST* to be the spell-out of a complex covert structure involving a past, a tense pronoun and a context time-shifter:

(46)



As before, we assume *Op-PAST* to carry the syntactic feature [iPAST], by means of which it syntactically licenses the presence of one or more past tense morphemes, *-ed*—carrying [uPAST]—, in its syntactic domain. With our pronominalized semantic implementation of *Op-PAST* we follow much of the established pronominal tense literature in assuming that tenses are the temporal analogue of pronouns, referring to times, whose reference is presuppositionally constrained (cf., e.g., Heim, 1994; Kratzer, 1998; Sauerland, 2002). Since in our proposal temporal features live purely in the syntax, constraining a past pronoun's reference to past times is presuppositionally realized by *Past*, a partial identity function on the domain of times which combines with a tense pronoun 1 and returns its input time solely in case that it lies strictly prior to the contextually given evaluation time t. Cooked into the denotation of *Op-PAST* is thus the commonly assumed, presuppositionally restricted tense pronoun in (47c):

(47) a. $[\![\,\text{Past}\,]\!]^{g,t} = \lambda t' : t' < t.\ t'$
b. $[\![\,1\,]\!]^{g,t} = g(1)$
c. $[\![\,\text{Past}_1\,]\!]^{g,t} = g(1)$ defined if and only if $g(1) < t$

Nevertheless, a past-restricted pronoun semantics is not the only meaning contribution of *Op-PAST* in our proposal. It furthermore enables the referentially-restricted pronoun it invokes to become the evaluation time of its complement clause. Since we assume that the evaluation time is part of the context, we therefore suggest that *Op-PAST* contains an additional component, i.e., an evaluation time shifter *T-Shift*. *T-Shift* takes scope over $g(1)$ and, in case no presupposition failure arises and $g(1)$ meets the anteriority presupposition, it relativizes the complement of *Op-PAST* to $g(1)$ as its new evaluation time.

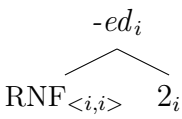
(48) $[\![\,\text{T-shift}\,]\!]^{g,t} = \lambda t'.\ \lambda P.\ [\![\,P\,]\!]^{g,t'}$

All things considered, *Op-PAST* then receives the following pronominal denotation:

(49) $[\![\,\textit{Op-PAST}\,]\!]^{g,t} = \lambda P :\ g(1) < t.\ [\![\,P\,]\!]^{g,g(1)}$

Similar to our treatment of *Op-PAST*, we take the past tense morpheme *-ed* to be the spell-out of a complex lower head: It is also mother to a partial temporal identity function and a tense pronoun. In contrast to *Op-PAST*'s partial identity function, *Past*, however, the temporal identity function *-ed* invokes, *RNF*, contributes a relative non-future presupposition to the semantics (cf. (51a)) .

(50)



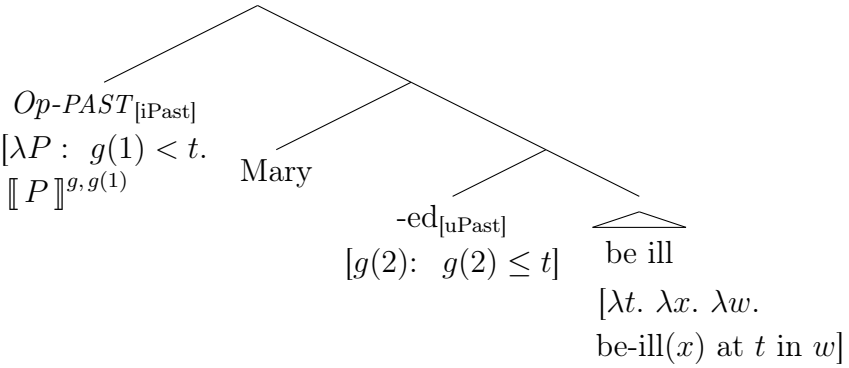
Jointly, the terminal nodes of the treelet *-ed* make up the past tense morpheme's semantics as in (51c):

(51) a. $[\![\,\text{RNF}\,]\!]^{g,t} = \lambda t' : t' \leq t.\ t'$
b. $[\![\,2\,]\!]^{g,t} = g(2)$
c. $[\![\,\textit{-ed}\,]\!]^{g,t} = g(2)$, defined iff $g(2) \leq t$

In a nutshell, we thus propose that *Op-PAST* takes a proposition of type $<s,t>$ as its input and shifts its evaluation time t to a pronoun $g(1)$ that is presupposed to be earlier than t, and each past tense morpheme *-ed* is a pronoun of type i that comes with a presupposition that it is no earlier than the local evaluation time t.

Under such assumptions, a simple past-tensed sentence like *Mary was ill* receives the logical form as in (52) and, as a result, the meaning in (53).

(52)



(53) $\llbracket (52) \rrbracket^{g,t} = \lambda w : g(2) \leq g(1) \wedge g(1) < t.$ be-ill(Mary, $g(2)$, w)

The semantics in (53) say that Mary is ill at a time interval $g(2)$ that is presupposed to be earlier than the local context time t. This is indeed the meaning that pronominal approaches to tense assign to such a sentence, as well.[7]

Assuming *say* to have the denotation in (56), the semantics spelled out in (47)–(51), yield the LF in (57) and the respective denotation in (58) for an SoT sentence like *John said Mary was ill.*

(56) $\llbracket \text{say} \rrbracket^{g,t} = \lambda P.\ \lambda t'.\ \lambda x.\ x$ says $\llbracket \text{P} \rrbracket^{g,t'}$ at t'

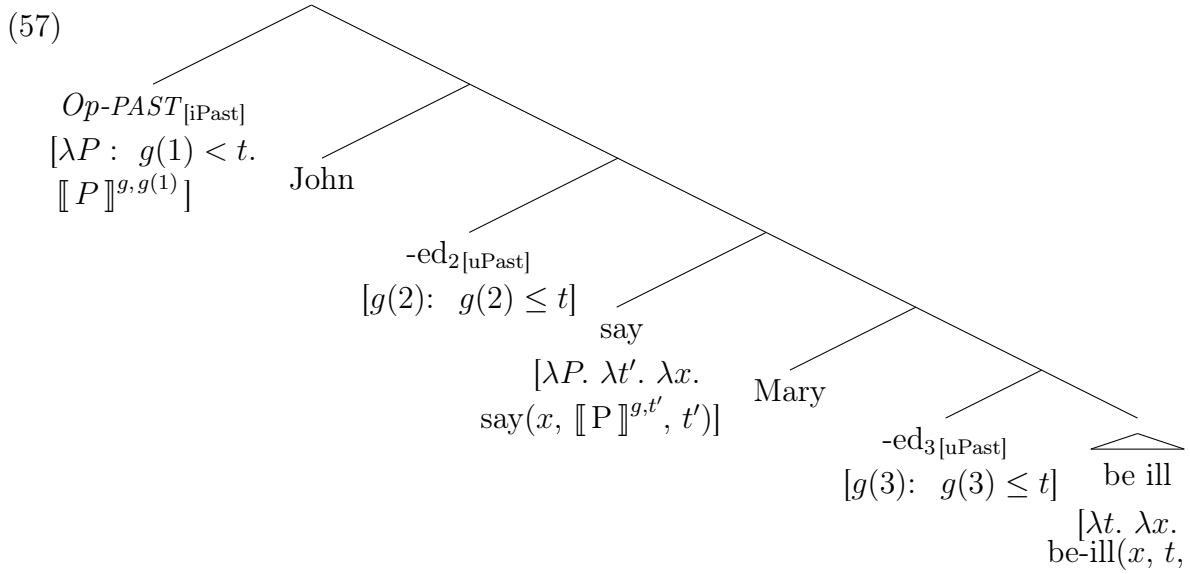
[7] Even though our proposal, including *T-shift*, is now fully pronominal and no longer quantificational, we would like to point out that it is even implementable without any operational component: Such an alternative implementation of the same idea in pronominal terms may, for example, involve making use of doubly-indexed pronouns (cf. Ogihara & Sharvit, 2012; Sharvit, 2018; Bar-Lev, 2014). According to this tradition, each tense is a pronominal expression that requires two times for its interpretation and, as a consequence, carries two indices. Crucially, the first index, denoting the event time, can be free, whereas the second, denoting the local evaluation time, must be λ-bound. Under such assumptions, the following denotations for *Op-PAST* and *-ed* can be provided:

(54) $\llbracket \textit{Op-PAST}_{i,j} \rrbracket^{g} = g(i)$, defined if and only if $g(i) < g(j)$

(55) $\llbracket \textit{-ed}_{k,l} \rrbracket^{g} = g(k)$, defined if and only if $g(k) \leq g(l)$

Self-evidently, *Op-PAST* under such an approach no longer contains an operational component. At the same time, it can be easily verified that this implementation also generates equivalent readings to the one introduced above. Since the two implementations make equivalent predictions, we will keep with the *T-Shift* version for the rest of this section, mostly for ease of presentation.

(57)



(58) $[\![(57)]\!]^{g,t} = \lambda w : g(3) \leq g(2) \wedge g(2) \leq g(1) \wedge g(1) < t.$ say(John, be-ill(Mary, at $g(3)$ in w), at $g(2)$ in w)
'*John said prior to t_u that Mary's illness started no later than his saying time.*'

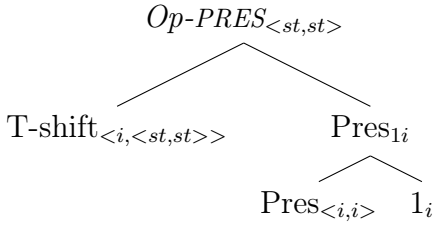
The proposal thus predicts the meaning of the sentence *John said Mary was ill* to be defined only if the time of John's saying event is no later than some time interval in the past and Mary's illness takes place no later than John's saying. Just like the quantificational version of this proposal, this version also correctly explains that the sentence is true in both a simultaneous and a backward-shifted context.

Having shown how the proposal works for simple past and past-embedded past sentences, it can be easily verified that the pronominal variant of our past-tense proposal also naturally generalizes to more complicated embeddings, such as those discussed in detail in Section 3 and makes equivalent predictions as its quantificational counterpart; It correctly derives the sim and b-s readings for past-embedded past tense, while keeping the intuitive meaning of matrix past tense intact, and it also explains further challenging embeddings, such as past-under-future uses. Crucially, we have shown that all this can be achieved in a straightforward pronominal way, without relying on the introduction of machinery that enables embedded tenses to be interpreted *de re*. This is possible since the assumption of underspecified past tense semantics obviates the necessity to assume two different LFs for the sim and b-s readings.

5.2 Pronominal present tense

As with the quantificational analyses, the same implementation can also be extended to present tense semantics without further complications. Along the lines of our pronominal past tense proposal, we assume both *Op-PRES* and the present tense morpheme *-s* to be complex tense heads. The components and their functions are entirely parallel to those of the past tense proposal, with the exception of the presuppositions that the relevant partial identity functions contribute. Both of these, however, are directly derived from the quantificational proposal introduced in Section 4. As a result, the following denotation arises:

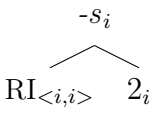
(59)



(60) $[\![\ \textit{Op-PRES}\ ]\!]^{g,t} = \lambda P :\ g(1) \supseteq t\ \&\ g(1) \supseteq t_u.\ [\![\ P\ ]\!]^{g,g(1)}$

Likewise, each present tense morpheme *-s* contributes the following semantics:

(61)



(62) $[\![\ \text{-}s\ ]\!]^{g,t} = g(2) \supseteq t.\ g(2)$

With these semantics in place, it can be easily shown that the proposal makes the same predictions as its quantificational counterpart in Section 4. Reconsider, for example, the mono-clausal present-tensed sentence *John is running*. With an LF akin to that (52), the following denotation is derived:

(63) John is running.

a. $[_{TP}$ *Op-PRES*$_{[\text{iPRES}]}$ $[_{vP}$ -s$_{[\text{uPRES}]}$ $[_{VP}$ John be running $]]]$

b.
i. $[\![\ VP\ ]\!]^{g,t} = \lambda t.\ \lambda w.$ be-running(John, at t in w)
ii. $[\![\ vP\ ]\!]^{g,t} = \lambda w : g(2) \supseteq t.$ be-running(John, at $g(2)$ in w)
iii. $[\![\ TP\ ]\!]^{g,t} = \lambda w : g(2) \supseteq g(1) \wedge [g(1) \supseteq t \wedge g(1) \supseteq t_u\ ]$.be-running(John, at $g(2)$ in w)

As before, since in this case $t = t_u$, *Op-PRES* generates an overlapping presupposition, and the sentence's denotation can be reduced to the following:

(64) $[\![\ \text{TP}\ ]\!]^{g,t} = \lambda w : g(2) \supseteq g(1) \wedge g(1) \supseteq t_u.$ be-running(John, at $g(2)$ in w)

Correctly, these semantics predict that sentence (63) can only be felicitously uttered in situations in which John's running time includes the time of utterance.

Likewise, the distinctive readings for embedded present tense follow naturally form this proposal. To see this, consider first the case of future-embedded present tense, which crucially may receive a relative interpretation (cf. (44)). For the derivation of these semantics assume again, uncontroversially, that pronominal *will* receives the denotation of *woll* (cf. (21)), but is syntactically restricted to present-tensed contexts via the feature [uPRES]. The semantics of a future-shifted present-tensed clause then emerge as follows (already collapsing the two presuppositions *Op-PRES* contributes since, again, it holds in this case that $t = t_u$):

(65) John will say Mary is ill.

a. [*Op-PRES*$_{1[\text{iPRES}]}$ [John [woll$_{2[\text{uPRES}]}$ [say [Mary [-s$_{3[\text{uPRES}]}$ [be ill]]]]]]

b. $\lambda w : g(3) \supseteq g(2)\ \wedge\ g(2) > g(1)\ \wedge\ g(1) \supseteq t_u.$ say(John, be-ill(Mary, at $g(3)$ in w), at $g(2)$ in w)

c. *John's saying happens strictly after the utterance time t_u and time of John's saying is included in the time of Mary's pregnancy.*

As in the quantificational version of this proposal, these semantics correctly predict that sentence (65) can be felicitously uttered in a scenario in which Mary is not ill at the time of utterance, but in which she is ill by the time of John's saying event. At the same time, it can also felicitously uttered in a scenario in which Mary is already ill at the time of utterance and remains to ill throughout, until the time of John's saying event.

Finally, the pronominal implementation of our proposal correctly explains d-a readings. In such a case, the dual nature of the present-tense presupposition becomes visible and the pronominal denotations of past and present tense combine in the following way:

(66) John said Mary is ill.

a. [*Op-PAST*$_{[\text{iPAST}]}$ [John [-ed$_{[\text{uPAST}]}$ [say [*Op-PRES*$_{[\text{iPRES}]}$ [Mary [-s$_{[\text{uPRES}]}$ [be ill]]]]]]]

b. $\lambda w : g(4) \supseteq g(3) \ \wedge \ [g(3) \supseteq g(2) \ \wedge \ g(3) \supseteq t_u] \ \wedge \ g(2) \leq g(1) \ \wedge \ g(1) < t_u$. say(John, be-ill(Mary, at $g(4)$ in w), at $g(2)$ in w)

c. *John's saying happens strictly before the utterance time t_u and both the time and the time of utterance are included in the time of Mary's pregnancy.*

With this section we hope to have shown that pronominal tense semantics and SoT effects, and also further puzzling embedded tense effects such as double-access readings, can be unified in a straightforward way. Our approach is able to derive these readings in a pronominal semantics without allusions to additional machinery. This means that SoT effects are fully compatible with both pronominal and quantificational approaches to the semantics of tense.

6 Conclusion

In this paper, we provide a novel syntactic-semantic account for SoT, which does not rely on two truth-conditionally distinct LFs for the derivation of the sim and b-s reading—a standard assumption recently called into question by, e.g., Altshuler and Schwarzschild (2012); Altshuler (2016). At the same time, we explain the systematic availability of both a sim and a b-s reading for past-under-past embeddings. Following, among others, Kusumoto (1999, 2005); Stowell (2007), we propose to disentangle the different meaning components of past tense via outsourcing its absolute past meaning into a structurally high, covert past operator (*Op-PAST*) while encoding a relative past meaning into the past tense morpheme (*-ed*), which is syntactically dependent on the aforementioned operator. The two readings are licensed via the weak precedence relation past tense morphology semantically contributes (i.e., 'no later than' semantics rather than the 'strictly earlier than' semantics, contributed by the high operator). We show that this approach can deal with the same challenges as other SoT approaches and has certain additional advantages as well, such as retaining the one-to-one mapping between past tense form and past tense meaning.

We furthermore demonstrate that the proposal is extendable to present tense without further complications. Here, too, we propose, that tense is made up of two semantically active components, i.e., a covert operator which introduces the 'real' present tense semantics and a relative component, which establishes inclusion relations between the relevant predicate times and the local evaluation times. The crucial component of this proposal is that we argue, along with others such as (Heim, 1994; Altshuler, 2016), that what has commonly been argued to be an exceptional reading of present tense, i.e., its d-a readings in present-under-past embeddings, should actually be part of the inherent meaning of past tense, for us of *Op-PRES*. In unembedded contexts, the local evaluation time of this operator falls together with the utterance time, which is why, in these cases, the semantic dual nature remains invisible. Once embedded under past tense, the dual semantics of present tense reveal themselves and immediately explain the double-access readings of such contexts.

In the final part of this paper, we argue that the semantic contributions of present and past tense that were proposed in Sections 2 and 4 can also be straightforwardly implemented in pronominal terms. Since the proposed analysis does not rely on distinct LFs for the derivation of the b-s and the sim readings of past-embedded past tense, we show that problems that standard pronominal tense theories face with respect to the meaning of embedded tense, do not carry over to our proposal. Our underspecification proposal can be cached out in both pronominal and quantificational terms.

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