Backshift and tense decomposition

Francisco Costa
University of Lisbon

António Branco
University of Lisbon

Proceedings of the 19th International Conference on
Head-Driven Phrase Structure Grammar

Chungnam National University Daejeon

Stefan Müller (Editor)

2012

Stanford, CA: CSLI Publications

pages 86–106

Costa, Francisco & António Branco. 2012. Backshift and tense decomposition. In Stefan Müller (ed.), *Proceedings of the 19th International Conference on Head-Driven Phrase Structure Grammar, Chungnam National University Daejeon*, 86–106. Stanford, CA: CSLI Publications. DOI: 10.21248/hpsg.2012.6.

Abstract

Backshift is a phenomenon affecting verb tense that is visible as a mismatch between some specific embedded contexts and other environments. For instance, the indirect speech equivalent of a sentence like *Kim likes reading*, with a present tense verb, may show the same verb in a past tense form, as in *Sandy said Kim liked reading*. We present a general analysis of backshift, pooling data from English and Romance languages. Our analysis acknowledges that tense morphology is ambiguous between different temporal meanings, explicitly models the role of the speech time and the event times involved and takes the aspectual constraints of tenses into consideration.

1 Introduction

The following pairs of sentences, adapted from Michaelis (2006), illustrate the phenomenon of backshift, visible in indirect speech. Each sentence in parentheses is the direct speech counterpart of the embedded clause in the same line:

(1) a. Debra said she **liked** wine. ("I like wine")
b. Debra said she **likes** wine. ("I like wine")
c. Debra said she **brought** the wine. ("I brought the wine")
d. Debra said she **had brought** the wine. ("I brought the wine")
e. Debra said she **would bring** some wine. ("I will bring some wine")

When the matrix verb is a past tense form, the verb tenses found in the embedded clauses are sometimes different from the tenses used in direct speech (1a, 1d, 1e), but not always (1b, 1c). For instance, in this context we sometimes find the simple past instead of the simple present in English (1a). In this respect English is in sharp contrast with Russian, where present tense can be used in similar embedded contexts with the same meanings as the English sentences using the simple past (example from Schlenker (2004)):

(2) Petya skazal, čto on plačet. (present tense in the embedded clause)
Petya said that he was crying.

An initial observation is thus that English uses tense in an absolute way (the embedded past tense in (1a) is used to locate a situation in the past), whereas Russian uses it in a relative way (the embedded present tense in (2) marks a situation that was present at the time that the situation in the matrix clause held). Based on similar data, Comrie (1986) argues that English exclusively uses tense in an absolute way. However, the example in (3), from Rodríguez (2004), shows that in some cases English also uses tense in a relative way. In this example, the past tense is associated with a situation that may hold in the future with respect to the speech time. The past tense here signals precedence with respect to the time of the event in the higher clause (which is in the future). The phenomenon is thus more

complicated than a simple separation between languages that use tense in a relative fashion and languages that use it in an absolute manner.

(3) María will tell us after the party tomorrow that she drank too much.

Several verbs trigger tense shifts in their complement. Reporting verbs are often identified with this group, but other verbs, like belief verbs or verbs like *decide* or *remember*, create similar contexts.

The phenomenon is also known as transposition, sequence of tenses or *consecutio temporum*, although some authors use some of these expressions in a broader sense, encompassing constraints on the co-occurrence of tenses in the same sentence. We reserve the term backshift to refer to the more specific case of the complements of the class of verbs just mentioned. In this paper, we focus on backshift, in this narrow sense. This is because backshift is more constrained than the general co-occurrence of different tenses in the same sentence. For instance, Rodríguez (2004) points out that relative clauses are temporally independent, as illustrated by the example in (4).

(4) Felipe spoke last night with a girl that was crying this morning.

Here, two past tenses are found, and the verb of the relative clause refers to a situation that temporally follows the one denoted by the matrix verb. In turn, in backshift contexts involving two past tense forms, the embedded tense never signals a time that temporally follows the time associated with the embedding tense:

(5) * Debra said last night that she brought a bottle of wine this morning.

In this paper we present a novel account of backshift and formalize it in HPSG. We use Minimal Recursion Semantics (MRS; Copestake et al. (2005)), but our account is quite neutral with respect to the theory or format of semantic representation used. We treat backshift as the result of the combination of three dimensions. The first one is acknowledging that tense, as it is visible in morphology, is ambiguous. The second one consists in classifying the meanings of the tenses along a number of lines: direction (present vs. past vs. future), aspect (perfective vs. imperfective), relativity (relative vs. absolute). Direction and aspect determine which kinds of temporal relations are involved in the meaning of tenses (inclusion, overlap or precedence relations). Relativity is how the arguments in these relations are chosen: absolute tenses always take the speech time as one of the arguments of one of these relations; relative times look at a perspective point, which can be the speech time or the time of another event, depending on the syntactic context. The third dimension is that some tenses may appear only in restricted contexts: they may occur only in contexts where the perspective point is the utterance time, or in contexts where these two times are different, or in both of these contexts.

Our analysis contains novel aspects. It provides a very clean distinction between absolute and relative tenses, making it depend on the use of two features. It

correctly constrains the possible readings of past under past constructions depending on grammatical aspect, which no other theory of backshift explains.

The paper proceeds as follows. In Section 2 we present the semantic representations for some tenses, which we will need in order to treat backshift. The analysis of backshift we propose is explained in Section 3. In Section 4 we compare this analysis with the treatments of backshift found in the literature. We conclude the paper in Section 5 with a summary of our contributions.

2 A Simple Representation of Tense

In this section we present a representation of the meaning of tenses that will be used in the analysis of backshift developed in Section 3.

Ambiguity of Tense Tense presents ambiguity at two levels:

- The same surface form can correspond to more than one grammatical tense. An English example is the verb form *put*, which can, for instance, be present tense or past tense. Some languages show this ambiguity in productive conjugation patterns. For instance, Portuguese *corremos* is both a present and a past form of the regular verb *correr* "run".

- The same grammatical tense can locate a situation in time in different ways. An English sentence like *I leave tomorrow* shows that present tense can refer to the future. This tense can also locate an event in the present. Other languages show similar cases.

We make a distinction between grammatical tense and semantic tense: we will use the first expression to refer to the morphological category, and the second one to refer to the meaning of tenses, i.e. their semantic representation.

In order to account for this two-fold ambiguity, we assume a two-layer analysis. The first layer consists in a set of rules that map surface form to grammatical tense. The second layer consists in a set of rules that map grammatical tense to semantic representations of tense. Both sets of rules are made of lexical rules, i.e. unary rules that apply to lexical items (verb forms in this case).

Description of the Tenses We assume a Davidsonian (Davidson, 1967) representation of situations which employs event variables as the first argument of the predicates. We model tense via an at relation that relates this event variable with a temporal index. A temporal index can be viewed as a free time variable, in the spirit of Partee (1973). The temporal index in this at relation is the event time of Reichenbach (1947). Also drawing inspiration from Reichenbach, we describe tense by resorting to various temporal indices and temporal relations between them. Temporal indices have their own type *t*. We represent the speech or utterance time by a subtype *s* of *t*. The at relation and the temporal relations holding between the

temporal indices are all introduced at the second layer of the lexical rules for tense (the layer that maps grammatical tense to semantic tense).

For our purposes, we do not need full Reichenbachian representations (relying on the three times: event time E, reference time R and speech or utterance time S) for many of the tenses: in some cases we will represent the temporal relation between the event time and the speech time directly, and say nothing about the reference time. For instance, we assume semantic present to be a temporal relation between S and E, in particular a temporal overlap relation. We follow Discourse Representation Theory (DRT; Kamp and Reyle (1993)[p. 541]) in further assuming that the speech time is seen as punctual, which means that this overlap relation is more specific than just overlap, and it is an inclusion relation: the event time includes the utterance time.

We distinguish between imperfective and perfective tenses as they occur in e.g. Romance and Slavic languages or Greek. We assume that present cannot be perfective and, similarly to Michaelis (2011), that languages without perfective vs. imperfective distinctions show ambiguity in the other tenses. The examples in (6) are hers and support this last claim. The highlighted verb in the English sentence in (6a) is lexically telic, but the sentence nevertheless has an imperfective reading. In (6b) the highlighted verb is lexically stative, but the clause where it occurs has a perfective reading. Since these are cases of aspectual coercion similar to the ones found with the perfective and imperfective past tenses, the English past tense must be ambiguous between the two.

(6) a. At the time of the Second Vatican Council, they *recited* the mass in Latin.

b. He lied to me and I *believed* him.

Similarly, future tense (or future constructions) is ambiguous in English as well as Romance languages with respect to perfectivity, in contrast to languages like Greek and Russian, that show perfectivity distinctions also in the future tenses.

The examples in Table 1 show the sort of temporal representation that we have in mind, using the situation of John smoking. We leave future tense aside, as it adds nothing new to the discussion. We also leave perfect aspect, as exemplified by the English present perfect, outside the scope of this text.

These representations are inspired by Kamp and Reyle (1993) and Van Eynde (1998). In the case of the past tenses, these authors assume that the relation between the location time of a situation and a perspective point (that corresponds to the utterance time) is determined by aspectual class. For states this is one of overlap. For non-stative situations this is, more specifically, one of temporal inclusion. It follows from the event time being included in the location time and the location time preceding the utterance time (the past tense semantics) that the event time also precedes the utterance time. This is essentially the simplified representation that we use here for the perfective past. Unlike these pieces of work, we do not make this distinction depend on aspectual type but rather assume that it is the difference

Semantic imperfective present: $smoke'(e, john') \wedge at(e, t) \wedge includes(t, s)$	"John smokes"
Semantic imperfective past: $smoke'(e, john') \wedge at(e, t) \wedge overlap(t, t_2) \wedge before(t_2, s)$	"John smoked"
Semantic perfective past: $smoke'(e, john') \wedge at(e, t) \wedge before(t, s)$	"John smoked"

Table 1: The meaning of some tenses

between imperfective and perfective tenses. It just happens that perfective tenses constrain the whole clause to be telic whereas imperfective tenses constrain it to be stative or at least atelic (de Swart, 1998, 2000; Bonami, 2002; Flouraki, 2006), which means that imperfective tenses trigger no aspect shift when they combine with states, and neither do perfective tenses when they combine with culminations or culminated processes. The following Portuguese examples, based on those in (6) above, motivate our departure from their analysis:

(7) a. Na altura do Segundo Concelho do Vaticano, recitaram a missa em Latim. (perfective)
At the time of the Second Vatican Council, they recited the mass in Latin (they did that just once).

b. Na altura do Segundo Concelho do Vaticano, recitavam a missa em Latim. (imperfective)
At the time of the Second Vatican Council, they recited the mass in Latin (they used to do that).

(8) a. Ontem acreditei nele. (perfective)
Yesterday I believed him (I believed what he said yesterday).

b. Ontem acreditava nele. (imperfective)
Yesterday I believed him (I still believed him).

The examples in (7) both exhibit the phrase *recitar a missa* "recite the mass", which is a culminated process (i.e. a telic situation). The sentences in (8) contain the stative verb *acreditar* "believe". In all cases there is a PP or an adverb that locates the described situations in time. The examples with the perfective forms describe situations that happen only once and within the time interval referred to by these modifiers. The imperfective sentences describe situations that are more prolonged in time and may extend outside the boundaries of these intervals.

Not explicitly shown in these representations are these aspectual (i.e. *Aktionsart*) constraints associated with the different tenses: as just mentioned, imperfective tenses (including present tense) constrain the eventuality being temporally located to be a state (possible results of this coercion include habitual readings,

epistemic readings, etc.), whereas perfective ones constrain it to be a telic situation (which can force inchoative readings, among others). For instance, the semantic representation of *smoke*, which is an activity/process lexically, used in the perfective past could include an operator to convert this activity into an accomplishment/culminated process. In the imperfective tenses a stative operator, like the habitual operator, could be present, in the spirit of de Swart (1998). For our purposes, however, we can ignore these aspectual constraints as they do not affect our analysis.

3 Backshift

For the purpose of handling backshift phenomena, we separate semantic tenses into two groups: relative tenses and absolute tenses. The *absolute tenses* always refer to the utterance time directly: they introduce in the semantic representation a temporal relation with the utterance time as one of its arguments. In turn, the *relative tenses* introduce a relation with a perspective point as one of its arguments. This perspective point is the utterance time if the corresponding verb is the head of the main clause of a sentence.[1] This perspective point is instead the event time of a higher verb, if that higher verb is a verb like *say*, triggering backshift.

For the HPSG implementation of such an analysis, revolving around this distinctive constraint of the perspective point and the utterance time, three features are employed: UTTERANCE-TIME, which represents the utterance time, or speech time; PERSPECTIVE-POINT, for this perspective point; and EVENT-TIME, for the event time. As mentioned before we use the type *t* for these features. There is also a subtype *s* of *t* for the speech time or utterance time. The feature UTTERANCE-TIME is declared to be of this more specific type.

We put the UTTERANCE-TIME feature under SS|LOC|CTXT|C-INDICES, as suggested in Pollard and Sag (1994) and in line with Van Eynde (1998). The feature PERSPECTIVE-POINT must be under S(YN)S(EM), since lexical items can constrain the PERSPECTIVE-POINT of their complement. We assume the two features are grouped together under a feature TIMES, which is under SS|LOC|CONT|HOOK, because they are relevant for the composition of semantics. This feature TIMES must be percolated in the appropriate places (headed phrases, etc.).

[1]This perspective point is similar to the perspective point assumed by DRT. Assuming that, in the case of matrix clauses, the perspective point is always the utterance time is a simplification that we make here because we are only interested in describing backshift (i.e. embedded clauses). The following example, from Kamp and Reyle (1993), illustrates the issue:

(1) Mary got to the station at 9:45. Her train would arrive at 10:05.

The perspective point of the second sentence must be the event time of the first sentence, so that this example can be accounted for by saying that conditional verb forms and *would* + infinitive constructions convey a semantic future tense anchored in a past perspective point. More cases where the perspective point of a main clause does not coincide with the utterance time are presented in Kamp and Reyle (1993)[p.595 and following ones].

The event time is always the second argument of the at relation introduced in the MRS representations by the lexical rules responsible for the semantic tenses:

$$\left[\begin{array}{l}\textit{semantic-tense-rule} \\ \text{SS}|\text{LOC}|\text{CONT}\left[\begin{array}{ll}\text{HOOK} & \boxed{1}\left[\begin{array}{lll}\text{LTOP} & \boxed{h1} & h \\ \text{INDEX} & \boxed{e1} & e \\ \text{TIMES}|\text{EVENT-TIME} & \boxed{t1} & t\end{array}\right] \\ \text{RELS} & \left\{\left[\begin{array}{ll}\textit{at} & \\ \text{LBL} & \boxed{h1} \\ \text{ARG0} & \boxed{e1} \\ \text{ARG1} & \boxed{t1}\end{array}\right]\right\} \cup B \cup \boxed{A} \\ \text{HCONS} & \boxed{C}\end{array}\right] \\ \text{DTR}|\text{SS}|\text{LOC}|\text{CONT}\left[\begin{array}{ll}\text{HOOK} & \boxed{1} \\ \text{RELS} & \boxed{A} \\ \text{HCONS} & \boxed{C}\end{array}\right]\end{array}\right]$$

where B is the semantic contribution of specific tenses, i.e. subtypes of *semantic-tense-rule*.

The temporal semantics we assume in this paper do not use constraints on handles, since all elementary predications are conjoined. For this reason, the HCONS of the mother is simply the HCONS of the daughter for all tense rules. The HOOK feature of the mother is also token-identical to the HOOK of the daughter. On the one hand, the LTOP and INDEX of the verb have to be made available higher in the tree for the composition of semantics. On the other hand, the feature EVENT-TIME has to be visible by the daughter node of this rule, since verbs that trigger backshift in their complement constrain this feature, as shown below. Depending on how the semantics of temporal location adverbials (such as *today*, *next month*, etc.) is implemented, this feature EVENT-TIME may also have to be available higher in the syntax tree. Therefore it is also in the HOOK of the mother.

The utterance time must be accessible at any point in a sentence (as argued above), so this feature must be unified across all *sign*s present in a feature structure. Therefore, syntax rules must unify the UTTERANCE-TIME of the mother with that of each of their daughters:

$$\left[\begin{array}{l}\textit{phrase} \\ \text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\ s \\ \text{DTRS}\left\langle\left[\text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\right], \ldots, \left[\text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\right]\right\rangle\end{array}\right]$$

The types for lexical rules must be constrained in a similar fashion. Additionally, in the start symbol, the features UTTERANCE-TIME and PERSPECTIVE-POINT are unified: the perspective point is thus the utterance time in matrix clauses:

$$\left[\text{SS}|\text{LOC}\left[\begin{array}{ll}\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME} & \boxed{1}\ s\\ \text{CONT}|\text{HOOK}|\text{TIMES}|\text{PERSPECTIVE-POINT} & \boxed{1}\end{array}\right]\right]$$

Because some verbs like *say* trigger backshift in their complement, but other elements do not, the relation between an item's perspective point and that of its complement is controlled lexically. For most items (the default case) they are unified, but in the case of backshift triggering elements, the P(ERSPECTIVE)-POINT of the complement is the EVENT-TIME of the head. This is encoded in the lexical types. For instance, lexical items that backshift the tense of their first complement include the constraint:

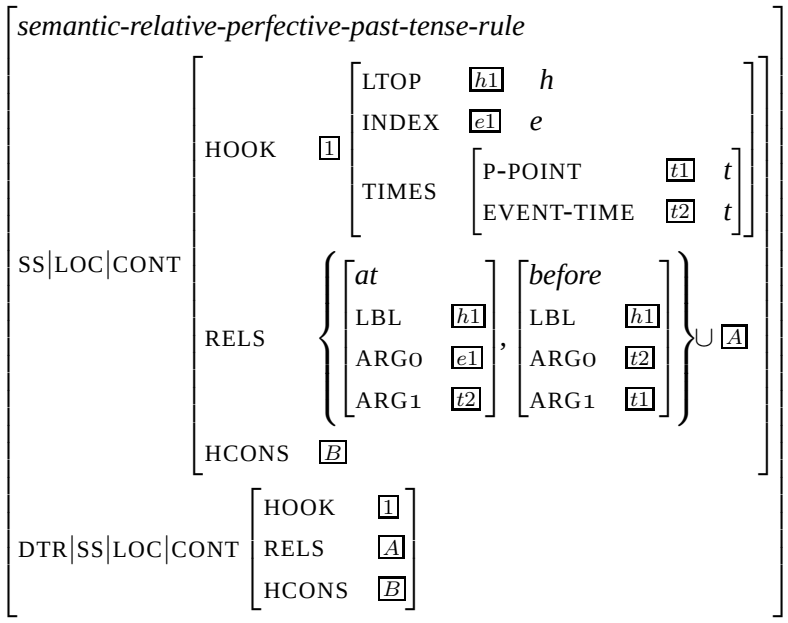
$$\left[\text{SS}|\text{LOC}\left[\begin{array}{l}\text{CAT}|\text{VAL}|\text{COMPS}\left\langle\left[\text{LOC}|\text{CONT}|\text{HOOK}|\text{TIMES}|\text{P-POINT}\quad\boxed{1}\quad t\right],\ldots\right\rangle\\ \text{CONT}|\text{HOOK}|\text{TIMES}|\text{EVENT-TIME}\ \boxed{1}\end{array}\right]\right]$$

The absolute tenses look at the feature UTTERANCE-TIME in order to find one of the arguments for the relevant temporal relation that they introduce in the semantics. The relative tenses look at the attribute PERSPECTIVE-POINT instead. As an example, the semantic perfective past tense is a relative tense. Consider:

(9) a. Kim lied.
$at(e_1, t_1) \wedge before(t_2, s) \wedge lie(e_1, kim')$

b. Kim said he lied.
$at(e_1, t_1) \wedge before(t_1, s) \wedge say'(e_1, kim', e_2) \wedge$
$at(e_2, t_2) \wedge before(t_2, t_1) \wedge lie(e_2, kim')$

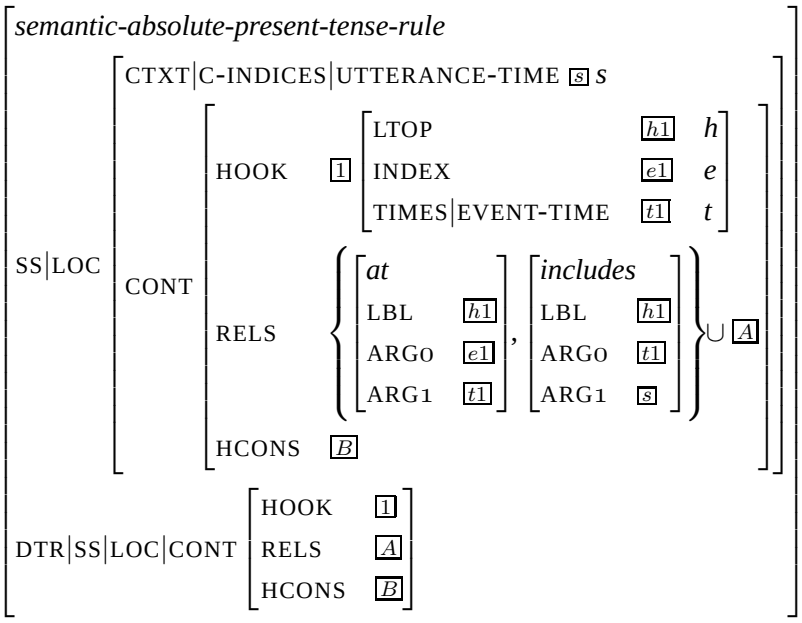
The second argument of the $before$ relation associated with semantic perfective past is not the utterance time (as has been presented so far) but rather the perspective point, because this tense is a relative tense. In the case of main clauses this perspective point is the utterance time—this is what happens in examples such as (9a), and it is also the case of the matrix verb in (9b). In the case of clauses occurring as the complement of verbs that trigger backshift, this perspective point is the event time of the higher verb. The example in (9b) is thus correctly analyzed as saying that the event of John lying precedes the saying event, as can be seen from the semantic representation provided in (9b). The AVM for the semantic perfective past tense rule thus includes the constraints:



By contrast, the semantic tense given by the English present tense, in examples like (1b) and (10) below, is an absolute tense.

(10) Kim said he is happy.
$at(e_1, t_1) \wedge before(t_1, s) \wedge say'(e_1, kim', e_2) \wedge$
$at(e_2, t_2) \wedge includes(t_2, s) \wedge happy'(e_2, kim')$

The semantic present carries an inclusion relation between the event time and another time. Because it is an absolute tense, this other time is always the utterance time, regardless of whether it occurs in backshifted contexts or regular ones.



English grammatical tenses	Semantic Tenses	Romance grammatical tenses
Simple present	Absolute (imperfective) present	Present
Simple past	Relative (imperfective) present	Imperfective past
Simple past	Relative imperfective past	Imperfective past
Simple past	Relative perfective past	Perfective past

Table 2: Mapping between some grammatical tenses and some semantic tenses, for English and Romance languages

We follow the strategy mentioned above in Section 2 of letting a grammatical tense be ambiguous between two or more semantic tenses. The relation between grammatical tense and semantic tense is language dependent, as shown in Table 2, where this mapping with semantic tense (middle column) is shown for some English grammatical tenses (left column) as well as some tenses in some Romance languages (right column).

The following examples illustrate each of the semantic tenses considered in this table under the influence of a higher past tense verb: the absolute present, denoting overlap with the utterance time, and represented by the English simple present in (11a);[2] the relative present, signaling overlap with the perspective point, and materialized in the English simple past in (11b); the relative imperfective past, marking precedence with respect to the perspective point, associated with a stative interpretation of the clause and realized by the English simple past in (11c); and the relative perfective past in (11d), similar to the relative imperfective past but associated with telic situations instead of stative ones.

(11) a. Kim said he is happy. (“I am happy”) *Absolute present*

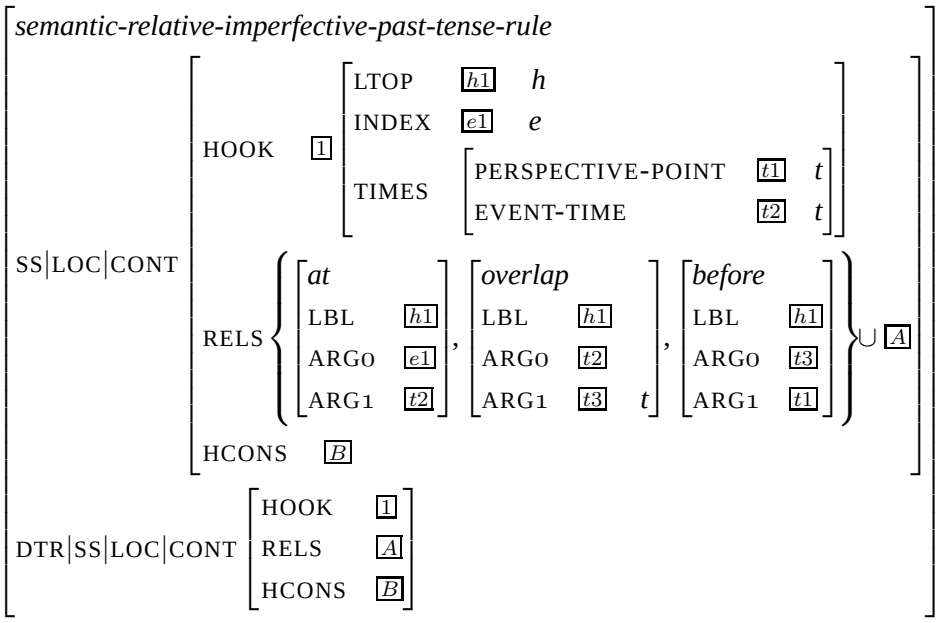
b. Kim said he was happy. (“I am happy”) *Relative present*

c. Yesterday Kim said he was happy when he was a child. (“I was happy when I was a child”) *Relative imperfective past*

d. Kim said he already had lunch. (“I already had lunch”) *Relative perfective past*

The constraints associated with the relative imperfective past are as expected from the discussion so far:

[2]The meaning of the “present under past” is not trivial (Manning, 1992), and we opt for a simplified view of it here.

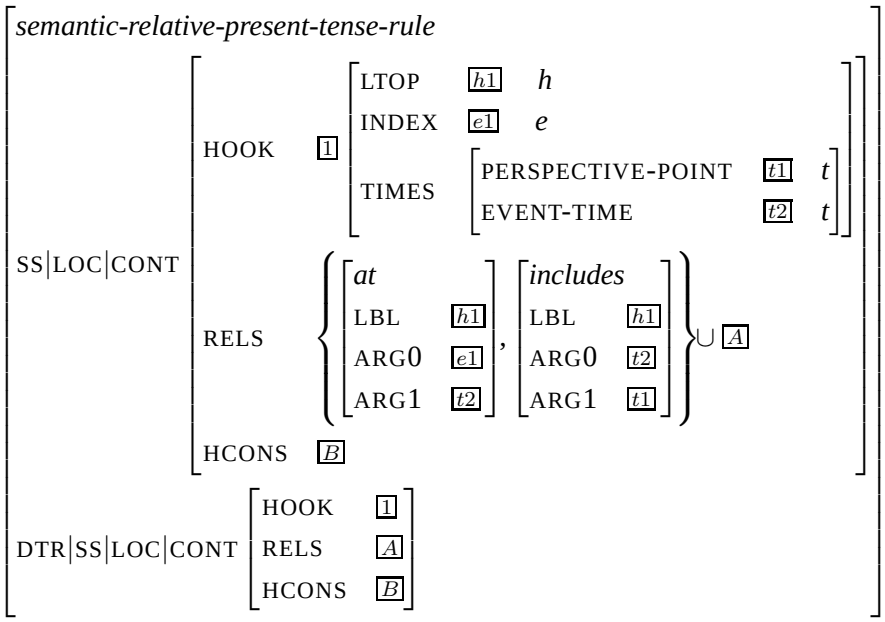


Both the English tense system and the Romance one show ambiguous past tenses. The English *simple past* can have the readings that the Romance grammatical perfective past has as well as those of the grammatical imperfective past. In the Romance case, the grammatical imperfective past is ambiguous between a semantic present (signaling temporal overlap) and a semantic past (marking precedence). In contexts with no tense shift, it is always a semantic imperfective past. However, in backshifted contexts it can also be a relative present tense. For instance, the Portuguese sentences that are translations of the examples (11b) and (11c) use the grammatical imperfective past. The direct speech equivalents can be the grammatical present or the grammatical imperfective past:

(12) a. O Kim disse que *era* feliz. (“Sou feliz”)

b. O Kim disse que *era* feliz quando era pequeno. (“Era feliz quando era pequeno”)

The relative present signals a temporal overlap relation between the time of the event denoted by the verb used in this tense and the perspective point: this is the reading for the examples in (11b) and (12a), where the two events overlap. We give this relative present tense (denoted by grammatical past in backshift contexts) a semantic representation similar to that assumed for the absolute present tense (denoted by grammatical present), the only difference is that the perspective point is used as the second argument of the $includes$ relation (it is a relative tense rather than an absolute one). These examples are thus analyzed as saying that the event time for the event described in the embedded clause includes the time of the event introduced by the matrix verb.



The only difference between the semantic relative present, given by the grammatical imperfective past, and the semantic absolute present, given by the grammatical present, is the second argument of the $includes$ relation that these two tenses introduce in the semantics. With the semantic relative present this is the perspective point, whereas with the semantic absolute present this is the utterance time.

Because the grammatical (imperfective) past cannot have a (relative) present reading in contexts with no tense shift, the lexical rule for this semantic tense (the relative present) must be constrained so that it only triggers in the appropriate syntactic context, namely in backshift contexts. There are a number of ways to do this. One may simply add the constraint that the perspective point has to be different from the utterance time. This solution is inadequate because it allows the grammatical (imperfective) past to have a semantic relative present reading in contexts where the perspective point is not the utterance time and is the event time of a verb that occurs in any tense that is not the present. Consider the following Portuguese example:

(13) A Maria dir-nos-á amanhã depois da festa que bebia demasiado. (imperfective past in the embedded clause)
Maria will tell us after the party tomorrow that she drank (i.e. used to drink) too much.

This sentence is similar to the one in (3) in that it contains a past tense clause embedded in a future tense clause. Whereas the past clause in (3) has a perfective reading (she drank too much at the party), the one in (13) displays an imperfective past. But despite being imperfective, the reading of temporal overlap with the main clause, of the sort that we find in (11b), is unavailable, and only the one of

temporal precedence is, as in (11c). For this reason, in cases such as this one, even though the perspective point is not the utterance time, the semantic relative present cannot be associated with the grammatical imperfective past. It is clear then that the semantic relative present can only occur in contexts where the perspective point is a past time.

An alternative that fixes this shortcoming is to use features to encode the temporal direction of temporal indices. This temporal direction can be first thought of as the location of the times denoted by temporal indices in the time line (*past*, *present*, *future*). As will be made clear shortly, this location is not absolute (i.e. it is not with respect to the speech time), so we use values like *backward*, *forward* and *no-dir(ection)* instead. We may think of a feature DIR(ECTION) appropriate for temporal indices, but instead we use two different features under TIMES: a feature P-DIR for the direction of the perspective point and a feature E-DIR for the direction of the event time. We do not use DIR features under temporal indices because the purpose of these features is to enforce a syntactic constraint (namely blocking semantic relative present tenses from occurring in the contexts where the perspective point is not a past time) and the temporal indices show up in the MRS representations produced by our analysis.

The possible values for these direction features are: *t(emporal)-dir(ection)* (the features P-DIR and E-DIR are declared to be of this type) and its three subtypes *no-dir*, *backward* and *forward*, which have no common subtypes.

The places where the PERSPECTIVE-POINT is constrained to be the utterance time also see the feature P-DIR to have the value *no-dir*. The revised constraints for the start symbols are thus:

$$\left[\begin{array}{l}\text{SS}|\text{LOC}\left[\begin{array}{ll}\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME} & \boxed{1}\ s \\ \text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{PERSPECTIVE-POINT} & \boxed{1} \\ \text{P-DIR} & \textit{no-dir}\end{array}\right]\end{array}\right]\end{array}\right]$$

As presented above, by default lexical items unify their complement's perspective point with their own perspective-point. These elements now additionally must unify their complement's P-DIR with their own P-DIR. The lexical items that trigger backshift on their complements identify their event time with their complement's perspective point. They now also identify their complement's P-DIR with their own E-DIR. For instance, verbs that backshift the tense of their first complement have the constraints:

$$\left[\begin{array}{l}\text{SS}|\text{LOC}\left[\begin{array}{l}\text{CAT}|\text{VAL}|\text{COMPS}\left\langle\left[\text{LOC}|\text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{P-POINT} & \boxed{1}\ t \\ \text{P-DIR} & \boxed{2}\ \textit{t-dir}\end{array}\right]\right], \ldots\right\rangle \\ \text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{EVENT-TIME} & \boxed{1} \\ \text{E-DIR} & \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

Finally, the lexical rules for the various semantic tenses constrain their E-DIR in the expected way: the semantic absolute present tense constrains it to take the value *no-dir*, past tenses with *backward* and future tenses with *forward*.

In the definition of the rule for the semantic relative present, the P-DIR feature has the value type *backward*. This means that this tense rule can only occur in contexts where the perspective point and the P-DIR feature have been constrained by a backshift triggering verb in the a past tense form. This constraint closely reflects the fact the the present tense reading (i.e. the temporal overlap reading) of the grammatical (imperfective) past tense only occurs in contexts where the perspective point is a past time, i.e. it is identical to the event time of another verb that is in a past tense:

$$\left[\begin{array}{l} \textit{semantic-relative-present-tense-rule} \\ \text{SS}|\text{LOC}|\text{CONT} \left[\begin{array}{ll} \text{HOOK} & \boxed{1} \left[\begin{array}{lll} \text{LTOP} & \boxed{h1} & h \\ \text{INDEX} & \boxed{e1} & e \\ \text{TIMES} & \left[\begin{array}{lll} \text{P-POINT} & \boxed{t1} & t \\ \text{P-DIR} & & \textit{backward} \\ \text{EVENT-TIME} & \boxed{t2} & t \\ \text{E-DIR} & & \textit{backward} \end{array}\right] \end{array}\right] \\ \text{RELS} & \left\{\left[\begin{array}{lll} \textit{at} & & \\ \text{LBL} & \boxed{h1} & \\ \text{ARG0} & \boxed{e1} & \\ \text{ARG1} & \boxed{t2} & \end{array}\right], \left[\begin{array}{lll} \textit{includes} & & \\ \text{LBL} & \boxed{h1} & \\ \text{ARG0} & \boxed{t2} & \\ \text{ARG1} & \boxed{t1} & \end{array}\right]\right\} \cup \boxed{A} \\ \text{HCONS} & \boxed{B} \end{array}\right] \\ \text{DTR}|\text{SS}|\text{LOC}|\text{CONT} \left[\begin{array}{ll} \text{HOOK} & \boxed{1} \\ \text{RELS} & \boxed{A} \\ \text{HCONS} & \boxed{B} \end{array}\right] \end{array}\right]$$

Note that for this tense the E-DIR is also constrained to be a *backward* looking one, just like for the past tenses. This is because of examples such as:

(14) O Kim disse que dizia que era feliz.
Kim said (perfective) that he said (imperfective; = "used to say") that he was happy.

This example shows that a clause in the semantic relative present can be embedded in another clause also in the semantic relative present. Since the semantic relative present needs a *backward* looking perspective point, it too needs to supply a *backward* E-DIR (which becomes the P-DIR of the complement clause due to the constraints just described), or at least leave it underspecified. It cannot constrain

its E-DIR to be *no-dir* even though it is semantically present in the sense that it denotes temporal overlap, as that would prevent this combination.

Furthermore, the values of these direction features are not absolute (i.e. relative to the utterance time), because of sentences like (3) and (13), and this is why we use the type names *backward*, *no-dir* and *backward* instead of *past*, *present* and *future*. Even though the embedded clauses in these examples will have a feature E-DIR with the *backward* value, they are not necessarily associated with past events (the preferred reading for (3) is arguably one according to which the drinking event is after the speech time).

Although this extra feature on the temporal indices may seem at first to make our temporal semantics redundant, as we now have two ways of describing the relation of an event time with a perspective point (the elementary predications describing various temporal relations between temporal indices and the direction features describing the temporal direction of temporal indices), it must be noted that they are in fact independently required, since they describe different things: as just mentioned for the example in (3), a *backward* looking event time does not necessarily mean the corresponding event is a past event.

4 Related Work

Many analyses of backshift and sequence of tense can be found in the literature, some of which we describe briefly. Reichenbach (1947), in his famous analysis of tense as involving temporal constraints between the speech time S and a reference time R on the one hand and between that reference point R and the event time E on the other, mentions the *permanence of the R-point*: a sentence like * *I had mailed the letter when John has come* is ungrammatical because the temporal constraints between R and S are incompatible in the two tenses involved (the past perfect constrains R to precede S while the present perfect constrains them to be simultaneous).

However, Reichenbach did not develop a full account of backshift. A Reichenbachian analysis of this phenomenon is that of Hornstein (1991), that posits a sequence of tense rule which associates the speech time S of an embedded clause with the event time E of the higher clause. In this analysis a conditional form of a verb is considered to be, underlyingly, a future form, which is transformed into a conditional form in backshift contexts. As pointed out by Gutiérrez and Fernández (1994), this fails to explain why the two tenses combine differently with adverbs like *yesterday*. If the conditional form in (15b) is a future form in deep structure, (15b) should be ungrammatical just like (15a) is:

(15) a. * Juan asegura que Pilar asistirá ayer a la fiesta.
Juan affirms that Pilar will attend the party yesterday.

b. Juan aseguró que Pilar asistiría ayer a la fiesta.
Juan affirmed that Pilar would attend the party yesterday.

The work of Comrie (1986) suffers from the same problem, as it also consists in a sequence of tense rule that transforms the tenses found in direct speech into the ones found in reported speech.

According to Declerck (1990), when two situations are located in time, there are two possibilities: either both of them are represented as related to the time of speech (absolute use of the tenses), or one situation is related to the time of speech while the second is related to the first (relative use, in the second case). In the second case, the simple past simply denotes overlap with a previous situation. This is very similar to our proposal, but we classify the different tenses as to whether they are relative or absolute, whereas Declerck (1990) assumes both possibilities for all tenses and lets pragmatics disambiguate, but these pragmatic conditions are never made explicit.

For Stowell (1993), past morphology is like a "past polarity" item that needs to be licensed by a Past operator (that in English is covert) outscoping it. The Past operator is what conveys the temporal precedence constraints present in the semantics. Past morphology can be bound by Past operators in different (higher) clauses, which explains sentences like (11b). The analysis of Abusch (1994) is similar in spirit, but it resorts to semantic rather than syntactic constraints.

Like us, Michaelis (2011) also assumes that the English simple past is ambiguous between two tenses (a perfective/eventive one and an imperfective/stative one). Because of this, and similarly to us, she is in a position where it is possible to account for the interplay between aspect and tense—i.e. perfective past clauses in backshift contexts are always anterior to the main clause event—, which the rest of the literature on backshift cannot explain.

However, the author fails to notice that and instead analyzes examples like (16), which is hers, as an example of an embedded imperfective/stative tense (when its translation to other languages shows that it should be viewed as an instance of a perfective tense). She then tries to obtain precedence effects from constraints coming from this imperfective tense, by deriving from it a semantic content similar to that of the English present perfect, which the grammatical imperfective past never has in languages like the Romance ones.

(16) He said that he paid $2000 for his property in 1933.

This relation between aspect and the possibility of the two past under past readings had been noticed by Enç (1986). The author mentions that statives allow two interpretations, one of simultaneity (17a) as well as one of precedence (17b) with respect to the event in the main clause. In the same context, non-statives do not exhibit the two readings that statives do. They only allow the precedence reading, as in (17c).

(17) a. John remembered that Jane was not even eighteen.

b. John remembered that Jane was not even eighteen when he met her.

c. John remembered that Jane flunked the test.

As the following examples in Portuguese show, this contrast is dependent not on the lexical aspect of the verb but on the aspectual type of the entire clause, i.e. whether a perfective or imperfective tense is used (as they constrain the aspectual type of the clause, as mentioned above).

(18) a. O John lembrou-se que a Jane tinha dezoito anos. (imperfective)
John remembered that Jane was eighteen.

b. O John lembrou-se que a Jane tinha dezoito anos quando a conheceu. (imperfective)
John remembered that Jane was eighteen when he met her.

c. O John lembrou-se que a Jane teve dezoito anos. (perfective)
John remembered that Jane was (once) eighteen.

d. O John lembrou-se que a Jane chumbou no teste. (perfective)
John remembered that Jane flunked the test.

e. O John lembrou-se que a Jane chumbava no teste. (imperfective)
John remembered that Jane flunked the test (e.g. she flunked it every time she tried).

f. O John lembrou-se que a Jane chumbava no teste quando a conheceu. (imperfective)
John remembered that Jane flunked the test when he met her (e.g. she flunked it every time she tried).

These examples show the combinations of perfectivity and the two lexical aspect classes considered by Enç (1986). The clauses with perfective past tense forms can only be interpreted as describing a situation that precedes the matrix one. The ones with imperfective forms are ambiguous and allow both simultaneity as well as precedence readings. The precedence readings are easier when the temporal location of the situation is mentioned explicitly, hence the *when* clauses. Our analysis correctly describes this generalization.

The collection of papers in Lo Cascio and Vet (1986) is about tense phenomena, including sequence of tense phenomena. Particularly relevant are those of Lo Cascio (1986), Rohrer (1986), Lo Cascio and Rohrer (1986) and Rigter (1986). Lo Cascio (1986) distinguishes between deictic tenses (those directly linked to the utterance time) and anaphoric tenses (those linked to the utterance time indirectly). This is similar to our distinction between absolute and relative tenses. Our use of a perspective point draws on the work of Rohrer (1986), which is an analysis of backshift for French in Discourse Representation Theory. Like us, the author uses it to relate embedded tenses to the time of matrix situations. More specifically, "the time denoted by the event of the matrix sentence becomes the temporal perspective point of the complement clause". The perspective point is necessary for those cases when the main verb shows future tense and the embedded one shows a past tense, like examples such as (3) illustrate. In such cases, past tense merely indicates precedence with respect to the perspective point, but not necessarily with the utterance time.

Van Eynde (1998) is a DRT-inspired analysis of English tenses in HPSG that also discusses transposition or sequence of tenses. Although he considers data such as the sentence in (19), rather than data involving the complement clauses of verbs like *say*, the data are nevertheless very similar. In the second sentence of (19) the simple past is a semantic present relative to a past perspective point introduced in the first sentence. However, the author does not discuss the use of simple past tenses to convey temporal precedence with the perspective point in transposition contexts, a possibility that is clearly available in backshift contexts, as examples like (1c) show.

(19) Mary had been unhappy in her new environment for more than a year. But now she felt at home.

More generally, the treatment of tense and aspect in HPSG includes the work of Van Eynde (1994, 2000), Bonami (2002), Goss-Grubbs (2005), and Flouraki (2006), among others.

5 Conclusions

In this paper we presented a cross-language account of backshift. We illustrated the problem with data from English and some Romance languages. Our approach relies on two levels of tense representation: the morphological one and the semantic one. The relation between these two levels is language dependent.

In this scenario, backshift is the result of the interaction of three key properties of tense: (i) grammatical tense can be ambiguous, (ii) the meaning of tense is the combination of three characteristics (direction, aspect, how the arguments of the temporal relations are chosen), and (iii) some of these combinations occur only in restricted contexts.

One strong point of our analysis is the clean distinction between the tenses that constrain the utterance time directly and the tenses that refer to an abstract perspective point, that needs to be resolved (as the utterance time or alternatively as the event time of a higher event). Another contribution is the correlation between perfectivity distinctions and the availability of temporal overlap readings in past under past constructions, which the remaining literature on the topic fails to explain.

References

Abusch, Dorit. 1994. Sequence of Tense Revisited: Two Semantic Accounts of Tense in Intensional Contexts. In Hans Kampf (ed.), *Ellipsis, Tense and Questions*, pages 87–139, University of Amsterdam, dYANA deliverable R.2.2.B.

Bonami, Olivier. 2002. A syntax-semantics interface for tense and aspect in French. In Frank Van Eynde, Lars Hellan and Dorothee Beermann (eds.), *The Pro-*

ceedings of the 8th International Conference on Head-Driven Phrase Structure Grammar, pages 31–50, Stanford: CSLI Publications.

Comrie, Bernard. 1986. Tense in Indirect Speech. *Folia Linguistica* 20, 265–296.

Copestake, Ann, Flickinger, Dan, Sag, Ivan A. and Pollard, Carl. 2005. Minimal Recursion Semantics: An Introduction. *Journal of Research on Language and Computation* 3(2–3), 281–332.

Davidson, Donald. 1967. The Logical Form of Action Sentences. In Nicholas Rescher (ed.), *The Logic of Decision and Action*, University of Pittsburgh Press.

de Swart, Henriëtte. 1998. Aspect Shift and Coercion. *Natural Language and Linguistic Theory* 16, 347–385.

de Swart, Henriëtte. 2000. Tense, aspect and coercion in a cross-linguistic perspective. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of the Berkeley Formal Grammar conference*, Stanford: CSLI Publications.

Declerck, Rennat. 1990. Sequence of Tenses in English. *Folia Linguistica* 24, 513–544.

Enç, Mürvet. 1986. Temporal Interpretation. In *Proceedings of the Fifth West Coast Conference on Formal Linguistics*, Seattle, Washington.

Flouraki, Maria. 2006. Constraining Aspectual Composition. In Stefan Müller (ed.), *The Proceedings of the 13th International Conference on Head-Driven Phrase Structure Grammar*, pages 140–157, Stanford: CSLI Publications.

Goss-Grubbs, David. 2005. *An Approach to Tense and Aspect in Minimal Recursion Semantics*. Masters Thesis, University of Washington, Seattle, Washington.

Gutiérrez, Angeles Carrasco and Fernández, Luis García. 1994. Sequence of Tenses in Spanish. *Working Papers in Linguistics, Università Ca'Foscari Venezia* 4, 45–70.

Hornstein, Norbert. 1991. *As Time Goes By*. Cambridge, USA: MIT Press.

Kamp, Hans and Reyle, Uwe. 1993. *From Discourse to Logic: An Introduction to Modeltheoretic Semantics, Formal Logic and Discourse Representation Theory*. Dordrecht: Kluwer.

Lo Cascio, Vincenzo. 1986. Temporal deixis and anaphor in sentence and text: Finding a reference time. In Vincenzo Lo Cascio and Co Vet (eds.), *Temporal structure in sentence and discourse*, pages 191–228, Dordrecht: Foris.

Lo Cascio, Vincenzo and Rohrer, Christian. 1986. Interaction between Verbal Tenses and Temporal Adverbs in Complex Sentences. In Vincenzo Lo Cascio and Co Vet (eds.), *Temporal structure in sentence and discourse*, pages 229–249, Dordrecht: Foris.

Lo Cascio, Vincenzo and Vet, Co (eds.). 1986. *Temporal Structure in Sentence and Discourse*. Groningen-Amsterdam Studies in Semantics, Dordrecht: Foris.

Manning, Christopher. 1992. Presents embedded under pasts. Manuscript.

Michaelis, Laura. 2006. Tense in English. In Bas Aarts and April McMahon (eds.), *The Handbook of English Linguistics*, Oxford: Blackwell.

Michaelis, Laura A. 2011. Stative by Construction. *Linguistics* 49, 1359–1400.

Partee, Barbara. 1973. Some Structural Analogies Between Tenses and Pronouns in English. *The Journal of Philosophy* 70, 601–609.

Pollard, Carl and Sag, Ivan. 1994. *Head-Driven Phrase Structure Grammar*. Stanford: Chicago University Press and CSLI Publications.

Reichenbach, Hans. 1947. *Elements of Symbolic Logic*. Berkeley: University of California Press.

Rigter, Bob. 1986. Focus Matters. In *Temporal structure in sentence and discourse*, pages 99–132, Dordrecht: Foris.

Rodríguez, Joshua P. 2004. *Interpreting the Spanish* Imperfecto*: Issues of Aspect, Modality, Tense, and Sequence of Tense*. Ph. D.thesis, The Ohio State University, Columbus, Ohio.

Rohrer, Christian. 1986. Indirect discourse and "consecutio temporum". In Vincenzo Lo Cascio and Co Vet (eds.), *Temporal structure in sentence and discourse*, pages 79–97, Dordrecht: Foris.

Schlenker, Philippe. 2004. Sequence Phenomena and Double Access Readings Generalized (Two Remarks on Tense, Person and Mood). In J. Lecarme and J. Guéron (eds.), *The Syntax of Time*, Cambridge, Mass.: MIT Press.

Stowell, Tim. 1993. Syntax and Tense. Manuscript.

Van Eynde, Frank. 1994. Auxiliaries and Verbal Affixes: A monostratal cross-linguistic analysis. Habilitation thesis, Katholieke Universiteit Leuven. Leuven, Belgium.

Van Eynde, Frank. 1998. Tense, Aspect and Negation. In Frank Van Eynde and Paul Schmidt (eds.), *Linguistic Specifications for Typed Feature Structure Formalisms. Studies in machine Translation and Natural language Processing*, volume 10, pages 209–280, Luxembourg.

Van Eynde, Frank. 2000. A constraint-based semantics for tenses and temporal auxiliaries. In R. Cann, C. Grover and P. Miller (eds.), *Grammatical interfaces in HPSG*, pages 231–249, CSLI Publications.