A syntax-semantics interface for tense and aspect in French*

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1 Introduction

Contemporary studies of the semantics of tense and aspect tend to rely on syntactic hypotheses that are at odds with those of a phrase-structure based and lexicalist approach to syntax, such as that embodied in HPSG. For instance, de Swart (1998) explicitly assumes that tense relations originate in a syntactic position distinct from that of the head verb of the clause; and the approach to aspectuality detailed in Verkuyl (1993, 1999) relies crucially on the hypothesis that (aspectually relevant) adjuncts occur outside of the basic clause—an assumption which is at odds with recent adjuncts-as-complements analyses (see e.g. Bouma et al. (2001)). The general goal of this paper is to show by example that there is no incompatibility between HPSG syntax and the semantics of tense and aspect, and that a careful consideration of the syntax-semantics interface sheds new light on the nature of aspectual phenomena.

I will focus on the analysis of tense, adjuncts and aspect shift in French. The first section reviews the analysis Henriëtte de Swart has been advocating for these phenomena (de Swart, 1998, 2000), with particular emphasis on so-called aspectual coercion operators. It will be shown that the distribution of these operators in semantic representations is not trivial, and is best accounted for by assuming that these operators are licensed by the presence of particular lexical information in the clause.

In the second section, I present an HPSG analysis of tense and aspect at the syntax-semantics interface. The analysis relies on Minimal Recursion Semantics (Copestake et al., 2000) to relate standard syntactic structures with de Swart-style semantic representations. The analysis has two crucial features: first, it assumes that the semantic contribution of tense originates in the verb's semantic representation, despite the fact that tense can get wide scope over other semantic elements. Second, it allows the occurrence of implicit aspectual operators to be controlled by the verb's tense, which accounts for their peculiar distribution.

*I would like to thank Gilles Boyé, Patrick Caudal, two anonymous HPSG 01 reviewers, and the audience at HPSG 01 in Trondheim for their comments, criticisms and suggestions.

Proceedings of the 8th International HPSG Conference, Norwegian University of Science and
Technology (3-5 August 2001)
Frank van Eynde, Lars Hellan and Dorothee Beermann (editors)
2002.CSLI Publications. http://csli-publications.stanford.edu/

2 Tense and implicit aspectual operators in French

2.1 The basic data

French has two past tenses that are known to differ in their aspectual properties, the *passé simple* ('simple past'), and the *imparfait* ('imperfective').[1] In simple sentences, the *passé simple* occurs when the eventuality description provided by the verb and its arguments is telic (1a); and the *imparfait* occurs when the eventuality description is atelic (1b).[2]

(1) a. Paul alla à la plage
Paul go-PS to the beach
'Paul went to the beach'

b. Paul dormait.
Paul sleep-IMP
'Paul slept.'

When a verb providing a telic description is inflected in the *imparfait*, the resulting sentence is typically grammatical, but gets a shifted reading. For instance, (2a) gets a progressive reading, and (2b) gets a habitual reading. Similar facts are found when a verb providing an atelic description is inflected in the *passé simple*. For instance, (2c) gets an inchoative reading.[3]

(2) a. Paul allait à Paris (quand il s'est mis à pleuvoir).
Paul go-IMP to Paris when it start-PS to rain
'Paul was going to Paris (when it started raining).'

[1] A third past tense in French is the *passé composé* ('composed past'), which has a syntax similar to that of the English present perfect. As the exact interpretation of the *passé composé* is the source of much debate, I leave it out of the discussion in this paper.

[2] The *imparfait* has a number of other uses which will not be discussed in this paper. Among these are the use of the *imparfait* in conditionals (i.a); the use of the *imparfait* in what Carlson and Spejewski (1997) call *generic passages* (i.b); and the so-called *imparfait narratif* ('narrative imperfective'), where the *imparfait* gets a narrative reading which is very hard to distinguish from that of a *passé simple* (i.c). In the last two cases, the *imparfait* seems to be compatible with an atelic eventuality description. In the remainder of this paper, these uses of the *imparfait* will be ignored.

(i) a. Si Marie était là, elle serait ravie.
If Marie be-IMP here she be-COND delighted.
'If Marie was here, she would be delighted.'

b. Chaque mardi, Jean déjeunait chez sa grand-mère. Il partait du bureau à onze heures. Il passait par la patisserie et achetait un gâteau. Il arrivait à onze heures et demie pour préparer le repas.
'Every tuesday, Jean had-IMP lunch with his grandmother. He left-IMP his office at eleven. He stopped-IMP at the bakery to buy a cake. He arrived-IMP at half past eleven to cook the meal.'

c. Jean apprit la mort de Marie le 23 octobre. Le lendemain, il partait pour Paris.
'Jean learned-PS Marie's death on october 23. He left-IMP for Paris the next day.'

[3] In (2) and in the rest of the paper, material in parentheses in the examples is present to highlight the reading under discussion, but is not necessary for the sentence to get this reading.

b. (Tous les matins,) Paul allait au bureau à pied.
All the mornings Paul go-IMP to-the office by foot
'(Every morning,) Paul walked to the office.'

c. (Soudain), Paul dormit.
Suddenly Paul sleep-PS
'(Suddenly), Paul slept.'

As is well known, when an atelic eventuality description is modified by a duration adverbial, the complex description is telic. In such a case, in French, only the *passé simple* is felicitous under its basic interpretation. The *imparfait* is possible only with a shifted interpretation, either habitual or iterative. Thus (3a) can only mean that Paul slept repeatedly for two hours at a given period, and not simply that he slept for two hours on some particular occasion.

(3) a. # Paul dormait pendant deux heures.
Paul sleep-IMP for two hours
(*intended*) 'Paul slept for two hours.'

b. Paul dormit pendant deux heures.
Paul sleep-PS for two hours
'Paul slept for two hours.'

2.2 de Swart's analysis

In a series of papers (de Swart, 1998, 2000; de Swart and Molendijk, 1999), Henriëtte de Swart has developed a DRT analysis of tense and aspect in French which attempts to account for the data in (1–3) by bringing together two crucial insights from the previous literature: with Kamp and Rohrer (1983), she assumes that *imparfait* sentences describe atelic eventuality descriptions, whereas *passé simple* sentences describe telic eventuality descriptions; and with Moens and Steedman (1988), she posits that the basic aspectual class of an eventuality description may be changed by the presence of a number of implicit aspectual operators—among which, progressive, iterative, and habitual operators.

De Swart's specific contribution is to state that tense morphemes do not in themselves act as aspectual operators, but simply locate in time the eventuality description provided by the rest of the sentence. Thus the *passé simple* and the *imparfait* have identical semantic contributions: they locate an eventuality in the past. Where they differ is in their selectional restrictions: whereas the *passé simple* selects for a telic eventuality description, the *imparfait* selects for an atelic eventuality description.

De Swart presents her detailed analysis as a DRS construction procedure in the style of that in Kamp and Reyle (1993) where individual linguistic signs are not associated with semantic contributions but with instructions for DRS modification. However, extrapolating from the DRT formulation, one can assume the following contributions. First, verbs (once combined with their arguments) provide eventuality descriptions, modelled as sets of eventualities. Second, tense morphemes provide relations between an eventuality description and a time. For instance, a past tense

provides a relation between an eventuality description D and a time t, and states that there is an eventuality e of type D which occurred at some time preceding t. Third, aspectual operators such as duration adverbials provide functions from eventuality descriptions to eventuality descriptions; implicit aspectual operators get the same semantic type. These assumptions force the semantic composition in a simple sentence to be as specified in (4): the tense relation provided by the tense morpheme has maximal scope, whereas the eventuality description provided by the verb (noted VD, for 'verbal description') has minimal scope. Aspectual operators are forced to take scope between the tense relation and the verbal description, since this is the only way for them to find arguments of the appropriate type.

(4) $\mathsf{Tense}(\mathsf{Asp\text{-}Op}_1(\ldots(\mathsf{Asp\text{-}Op}_n(\mathsf{VD}))\ldots))$

The data in (1–3) is then accounted for as follows. Both (5a) and (5b) are conceivable semantic representations for (2a). But since the *imparfait* relation requires its argument to be an atelic description, and *aller à Paris* is telic, the representation in (5a) is ill-formed.[4] (5b) poses no such problem, since the progressive operator takes a telic or an atelic description as its input and provides an atelic description as its output; and thus provides an appropriate argument for the *imparfait* relation.

(5) a. imparfait(Paul-go-to-Paris)) (ill-formed)
b. imparfait(progressive(Paul-go-to-Paris)) (well-formed)

A similar reasoning applies to (2b). In (2c), the basic reading is unavailable because *Paul-dormir* is atelic and the *passé simple* requires an atelic argument. But we get a possible reading if an inchoative operator is present, which takes the atelic *Paul dormir* as input and provides a telic description as which is an appropriate argument for the *passé simple*. In a similar way, although one could want to take (6a) as the semantic representation associated with (3a), this representation is ill-formed, because the durative adverbial provides a telic description which the *imparfait* cannot take as its argument; but (6b) is fine: the habitual operator takes the telic description provided by the adverbial as its argument, and it provides an atelic, habitual description, which can then be the argument of the *imparfait* relation.

(6) a. imparfait(for-2-hrs(Paul-sleep)) (ill-formed)
imparfait(habitual(for-2-hrs(Paul-sleep))) (well-formed)

In the remainder of this paper, I will take the purely semantic part of de Swart's analysis to be correct, and concentrate on the way semantic representations such as those in (5) and (6) are assigned to sentences such as (2a) and (3a).[5] In this respect, two issues arise. First, the representations in (4–6) assume that the tense relation can get scope higher than duration adverbials, despite

[4]Technically, in de Swart's analysis, the construction procedure does not yield any DRS corresponding to (5a). One could alternatively take (5a) to be a well-formed representation with no interpretation.

[5]The analysis proposed by de Swart for the data in (1–3) is by no means the only conceivable one. In particular, there is a strong tradition of interpreting this data in terms of a distinction between situation type and point of view; see e.g. (Smith, 1991; Gosselin, 1996; Caudal, 2000) for recent proposals along these lines.

the fact that tense is realized on the head verb. Second, the implicit aspectual operators which play a crucial role in the analysis of shifted readings must be licensed in some way.

The first issue will be tackled in the second section of the paper, where I will show how the use of scope-underspecified semantic representations allows for a lexicalist analysis of tense compatible with the semantics assumed here. The second issue is discussed in more detail in the following paragraph.

2.3 The licensing of implicit aspectual operators

De Swart takes the presence of implicit aspectual operators in the semantics of sentences such as (2) or (3a) to illustrate a *coercion* phenomenon. The conception of coercion phenomena appealed to is familiar from work on the aspectual verb *commencer/start* (Pustejovsky, 1991; Copestake and Briscoe, 1992; Godard and Jayez, 1993; Pustejovsky and Bouillon, 1996): a coercion phenomenon is a case where a meaning shift is introduced in the semantic composition to avoid a type clash between a function and a candidate argument to that function.[6]

Coercion phenomena are typically analyzed by postulating so-called *coercion operators*, which come into play in the semantic composition when and only when a type clash licenses them. An immediate advantage of a coercion analysis of implicit aspectual operators is that it avoids a proliferation of implicit operators: the number of aspectually sensitive items in a sentence provides an upper bound on the number of implicit operators.

In the case of the particular coercion analysis in de Swart (1998), coercion operators are introduced in the DRS as underspecified semantic functions which can be resolved to a number of distinct aspectual operators. For instance, a mismatch between the *imparfait* and a telic argument licenses an underspecified telic-to-atelic function, which can be resolved to the progressive, the iteration or the habitual operator. A consequence of this analysis is thus that implicit operators are licensed only on the basis of the aspectual class of their input and output: individual operators cannot be subject to particular constraints.

The present paragraph attempts to clarify the status of implicit aspectual operators, and shows that de Swart's coercion analysis runs into two difficulties. First, some implicit operators can appear even when no type clash licenses them, and thus cannot be taken to illustrate a coercion phenomenon in the standard sense. Second, in some cases, the presence of a given implicit operator is not licensed in a sentence despite the fact that it would resolve a type clash; this shows that there are grammatical constraints on the occurrence of implicit aspectual operators, which can't be accounted for by de Swart's underspecified coercion functions. Finally, I argue that the distribution of implicit aspectual operators is best described by assuming that they are licensed by individual

[6] At least this is implied by the following citation: "Coercion [...] is governed by implicit contextual reinterpretation mechanisms triggered by the need to resolve aspectual conflicts" (de Swart, 1998, p. 360). de Swart (2000) is not so clear: "Coercion is the general terms for contextual reinterpretation (cf. Pustejovsky 1995). In this paper, we will reserve the term for cases of aspectual reinterpretation. [...] The most clearcut examples of aspectual reinterpretation arise when an eventuality description does not meet the input requirements of an aspectual operator, and we get an adjustment, a coerced interpretation of the input, which repairs the mismatch." (de Swart, 2000, p. 7). This passage seems to imply that coercion could be triggered by something other than a type mismatch. The question is then why such a phenomenon should be called 'coercion' or 'reinterpretation' at all.

lexical items rather than being inserted by some general coercion phenomenon.

2.3.1 Unrestricted operators

Among the implicit operators which are needed in an analysis of French, some are clearly not coercion operators, in the sense that they do not need a type clash in order to be licensed. This is shown most clearly by looking at sentences in the future tense.

In French, although the past tenses are sensitive to the aspectual class of the eventuality description they combine with, the future tense is aspectually neutral. This is shown by the fact that it combines felicitously with both telic and atelic descriptions in their basic interpretation: both (7), where the future tense is combined with an atelic description, and (8), where it is combined with a telic description, are grammatical.[7]

(7) a. Paul dormira.
Paul sleep-FUT
'Paul will sleep.'
b. fut(Paul-sleep)

(8) a. Paul ira à la plage.
Paul go-FUT to the beach
'Paul will go to the beach.'
b. fut(Paul-go-to-the-beach)

If iterative and habitual operators were coercion operators, we would then expect sentences in the future tense to lack iterative and habitual readings altogether, since there can be no type clash. But of course, (9) has the same three readings as its English counterpart: a basic reading, an iterative reading and an habitual reading.

(9) a. Paul arrosera les plantes.
Paul water-FUT the plants
'Paul will water the plants.'
b. fut(Paul-water-the-plants)
fut(habitual(Paul-water-the-plants))
fut(iterative(Paul-water-the-plants))

Therefore I conclude that neither the habitual nor the iterative operator are coercion operators: it is not necessary for a type clash to occur for these operators to be licensed.

[7] In (7) and later examples, some possible readings of the sentence are made explicit using informal semantic representations. A star ("*") before a semantic representation does not indicate that this representation is ill-formed, but that the sentence under consideration (unexpectedly) does not have a reading corresponding to this representation.

2.3.2 Restricted operators

The preceding argument shows that not all implicit aspectual operators are coercion operators, but it does not show that none of them is. In fact, the *progressive* operator contrasts with the habitual and the iterative in the context of the future tense.

If the progressive operator is a coercion operator, we do not expect sentences in the future tense to have progressive readings, since the progressive cannot be licensed by a type clash between the tense relation and the base eventuality description. This prediction is borne out: (10) has no progressive reading. This is shown by the fact that the *when* clause cannot describe an interruption of the journey towards the beach, as it would do on a progressive reading, but it can only specify the starting point of the journey.[8]

(10) a. Paul ira à la plage (quand il se mettra à pleuvoir).
Paul go-FUT to the beach when it start-FUT to rain
'Paul will go to the beach (when it starts raining).'

b. fut(Paul-go-to-the-beach)
*fut(progressive(Paul-go-to-the-beach))

Thus the progressive is licensed in the immediate scope of the *imparfait*, but not in the immediate scope of the future tense, and can thus be analyzed as a coercion operator.

However, if the progressive is a plausible candidate for a coercion operator in general, it is not under the particular analysis of coercion proposed by de Swart.[9] As stated earlier, de Swart's analysis entails that every semantically appropriate operator is licensed *whenever* a type clash occurs. In the present case, a progressive reading should arise whenever the syntactic composition of a sentence ends up giving a telic argument to a relation requiring an atelic one. The following data shows that the distribution of the progressive operator is much more restricted than what de Swart's analysis predicts.

First, the progressive operator is not licensed in the scope of a *pendant* duration adverbial. As was stated in section 1, *pendant* adverbials take an atelic argument. If a *pendant* adverbial is combined with a verb providing a telic description, we thus expect the progressive to be licensed by the type clash. But in fact, no progressive reading arises in such a case, and an iterative or habitual reading is found.

The progressive is not possible in the scope of a *pendant* adverbial:

[8]Notice that this cannot be attributed to a semantic incompatibility of the future tense with progressive interpretations. There is an overt periphrastic progressive construction in French, *être en train de* (literally 'to be in the course of'), and periphrastic progressives are fine in the future:

(i) a. Paul sera en train d' aller à la plage quand il se mettra à pleuvoir.
Paul be-FUT in course of go to the beach when it start-FUT to rain
'Paul will be going to the beach when it starts raining.'

b. fut(progressive(Paul-go-to-the-beach))

[9]See (White, 1994, 124–127) for similar arguments against a coercion analysis of implicit operators occurring in English, and (Jayez, 1999) for a similar observation on the predictions of de Swart's proposal.

(11) a. Paul démontra le théorème pendant une heure.
Paul prove-PS the theorem for an hour
'Paul proved the theorem for an hour.'

b. *passé-simple(for-an-hour(progessive(Paul-prove-the-theorem)))
passé-simple(for-an-hour(iterative(Paul-prove-the-theorem)))

Second, the adverbial *depuis une heure* takes an atelic description as its argument and specifies the duration of the described eventuality up to the reference time, as shown in (12). If the progressive operator was a coercion operator, we would expect the progressive operator to make it possible for a telic description to be the argument of *depuis une heure*. This is not the case, as (13) shows. Rather, the only reading we find is the (pragmatically odd) habitual reading stating that for an hour, Paul used to go Paris.

(12) a. Paul dormait depuis une heure.
Paul sleep-IMP DEPUIS an hour
'Paul had been sleeping for an hour.'

b. imparfait(DEPUIS-1-hour(Paul-sleep))

(13) a. ?? Paul allait à Paris depuis une heure (quand le train s'arrêta).
Paul go-IMP to Paris DEPUIS one hour when the train SELF stop-PS.
(intended, approx.) 'Paul had been going to Paris for an hour when the train stopped.'

b. imparfait(DEPUIS-1-hour(progressive(Paul-go-to-Paris)))

Third, the aspectual verb *commencer* 'to begin' is known to be incompatible with achievement descriptions. This is shown by (14), which can only get a habitual or iterative reading. If the progressive were a coercion operator, we would expect it to be licensed in this context too; but (14) has no progressive reading. Notice that the absence of a progressive reading cannot be attributed to an incompatibility between the progressive and achievements, since progressive readings of achievement verbs are found in the *imparfait* (15).

(14) a. Paul commença à atteindre le sommet.
Paul begin-PS to reach the top
'Paul started reaching the top.'

b. ps(start(habitual(Paul-reach-the-top)))
*passé-simple(start(Paul-reach-the-top)))
*passé-simple(start(progressive(Paul-reach-the-top)))

(15) a. Paul atteignait le sommet (quand il s'est mis à pleuvoir)
Paul reach-IMP the top when it started to rain
'Paul was reaching the top when it started raining'

b. imparfait(progressive(Paul-reach-the-top))

To conclude this examination, it appears that the distribution of the progressive operator is very restricted. In fact, I am not aware of any compelling case where the implicit progressive operator

must be taken to occur in the semantic composition while it is not in the immediate scope of the *imparfait*.[10]

The progressive is not the only implicit operator with a restricted distribution, although it is the most well studied. For instance, a case can be made for an "achievement-to-accomplishment" implicit operator with a limited distribution.

It is well-known that achievement descriptions are compatible with *en* ('in') duration adverbials, but that the measure adverbial does not specify the duration of the achievement, but rather the duration of an accomplishment that culminates with this achievement. So for instance, (16) does not specify that the event of reaching the top lasted one hour, but that the whole climb lasted one hour.

Following Moens and Steedman (1988), this can be accounted for by assuming that in (16), an implicit aspectual operator ACH-TO-ACC intervenes between the tense relation and the verbal description. This aspectual operator returns an accomplishment whose culmination is the achievement it takes as its argument.

(16) a. Paul atteignit le sommet en une heure.
Paul reach-PS the top in an hour
'Paul reached the top in an hour.'

b. passé-simple(in-an-hr(ach-to-acc(Paul-reach-the-top)))

Interestingly, when achievement descriptions are in the *imparfait* with a progressive interpretation, one does not get the same effect: the sentence describes an eventuality corresponding to the final stages of the climb, not to the whole climb. This is shown by the fact that the *when* clause in (15) can only refer to a moment occurring just before Paul reaches the top. Likewise, this ACH-TO-ACC operator is not found in the scope of *commencer* in (14), where it would have licensed an episodic reading. This shows that the occurrence of the implicit aspectual operator ACH-TO-ACC is licensed lexically by the aspectual adjunct *en une heure*. Since there is no aspectual adjunct in (15), ACH-TO-ACC is not licensed, and thus we get no reading where the rain starts at an arbitrary point of the climb.

More generally, it seems that an adequate account of tense and aspect in French must assume that the occurrence of some aspectual operators is lexically controlled by the presence of an overt aspectually sensitive element: a verb in the *imparfait* for the progressive operator, and an *en* adverbial for ACH-TO-ACC.

2.4 An alternative to coercion: lexical licensing

The preceding discussion shows that implicit aspectual operators come in two classes. Unrestricted operators such as the habitual operator can occur in the scope of any aspectually sensitive element;

[10] One could be tempted to conclude from this observation that some form of progressive is *the* semantic contribution of the *imparfait* (see (Jayez, 1999) for a proposal along these lines). The disadvantage of such an analysis is that it does not account for the existence of many fine, non-progressive readings of the *imparfait* (see e.g. (1b), (2b), (3a)). It might be the case that a unified semantics can be defined for the *imparfait*, which accounts for the progressive flavor of some uses and the absence of a progressive flavor in other uses. In the absence of such a definition, postulating a progressive operator distinct from the tense itself seems preferable.

and restricted operators such as the progressive occur only in the scope of a very restricted class of aspectually sensitive items.

De Swart's coercion analysis of implicit aspectual operators does not seem to be able to provide an adequate model of aspect shift: in the case of unrestricted operators, the analysis undergenerates by not allowing readings which are not motivated by a type clash. In the case of restricted operators, the analysis overgenerates by allowing operators in contexts where a type clash is not enough.

To account for the data, what is needed is for the occurrence of particular implicit operators to be directly linked to the presence of overt linguistic material in the sentence. For instance, we need to express the fact that there is a link between the progressive operator and the *imparfait* inflection. A way to express that link is to state that each implicit operator must be licensed by the lexical item which provides the relation dominating it in the semantic representation.

Under such an approach, each implicit aspectual operator must be in the immediate scope of either a tense relation or the operator relation expressed by some overt item (for instance a measure adverbial). Just as with the coercion analysis, this gives us an upper bound on the number of implicit operators which can occur in the semantic representation of a sentence: no implicit operator can be in the immediate scope of another implicit operator. But this approach has two immediate advantages over the coercion analysis. First, an operator can occur in the semantic representation even in the absence of a type clash, as in the case of future habituals. Second, lexical items get control on which implicit operators they license, which allows one to formulate constraints on the occurrence of restricted operators; for instance, a verb in the *imparfait* licenses a progressive operator, but a verb in the future tense does not.

3 An HPSG analysis

This section presents an HPSG analysis of tense and aspect in French which accounts for the data presented in the preceding section. The analysis relies crucially on the use of scope-underspecified semantic representations to account for apparent mismatches between phrase structure and semantic composition. This paper uses Minimal Recursion Semantics (Copestake et al. (2000)) to this end, although it is clear that other systems with similar analytic goals could get the same results.

Since this paper is mostly concerned with the syntax-semantics interface, I will only make minimal assumptions on the ontology aspectual information is built on; in fact, the semantic representations I will arrive at are compatible with a number of different ontological hypotheses.[11] My strategy is to assume semantic representations analogous to those of de Swart, and to try to specify the syntax-semantics interface in detail.

3.1 General assumptions

As usual in MRS, I assume that the semantic content of linguistic signs is specified as a list of elementary predications under the feature RELS. Each elementary predication has a HANDLE which

[11] For instance, it is agnostic as to whether it is eventuality descriptions or eventualities themselves which are subject to aspectual classification; see paragraph 3.1.3.

is used to indicate its position in the overall semantic representation, and some relations also take handles as arguments; the fact that relation r takes the handle of relation r' as its argument represents the fact that r' is in the immediate scope of r.

MRS representations are underspecified for scope, since the grammar can leave implicit which handle is the argument of some relations. Grammatical constraints on scope can be stated as relations on handles specified under the feature H-CONS. To an MRS representation corresponds a collection of *resolved* MRSs, in which handles have been equated in order to arrive at a scopally fully specified representation.

3.1.1 Relation types

To state an MRS analysis of tense and aspect, the first task is to define relation types resulting in a semantic composition analogous to that proposed in (4), repeated here in (17).

(17) $\mathsf{Tense}(\mathsf{Asp\text{-}Op}_1(\ldots(\mathsf{Asp\text{-}Op}_n(\mathsf{VD}))\ldots))$

First, I postulate that tense relations take scope, and bind an eventuality variable with the feature BEV (BOUND EVENTUALITY VARIABLE). Tense relations also take a TIME argument, which specifies the time index to which the time of the described eventuality is compared by the tense.[12]

Second, the KEY relation of every verb has an eventuality argument, which is given as the value of the feature EVY. In the most simple examples, the tense relation scopes over the KEY relation of the head verb, and binds its eventuality variable. This is shown in (19) with a sentence in the *imparfait*.[13]

(18) a. *tense-rel*$\rightarrow$
$$\begin{bmatrix} \text{HANDLE} & \textit{handle} \\ \text{SCOPE} & \textit{handle} \\ \text{BEV} & \textit{evy-ind} \\ \text{TIME} & \textit{t-ind} \end{bmatrix}$$

b. *verb*$\rightarrow$
$$\left[\text{KEY} \quad \left[\text{EVY} \quad \textit{evy-ind}\right]\right]$$

(19) Il pleuvait.
It rain-IMP
'It rained.'
$$\left\langle \begin{bmatrix} \textit{imp-rel} & \\ \text{HANDLE} & \boxed{1} \\ \text{SCOPE} & \boxed{2} \\ \text{BEV} & \boxed{x} \end{bmatrix}, \begin{bmatrix} \textit{pleuvoir-rel} & \\ \text{HANDLE} & \boxed{2} \\ \text{EVY} & \boxed{x} \end{bmatrix} \right\rangle$$

Third, aspectual operators (be they overt or implicit) share with tenses the property of taking scope over an eventuality description , and they share with verbal KEY relations the property of

[12] When a tense relation is used in a root clause, this time index will eventually get identified with the utterance time as specified under C-INDS.

[13] To improve readability, I use letters from the end of the alphabet instead of numbers as tags for indices.

providing a new eventuality description. Accordingly, I assume that they have both the BEV feature and the EVY feature. The scope-resolved MRS for the progressive of a simple sentence is given in (21):[14] the tense relation scopes over the progressive and binds its eventuality variable (x), and the progressives scopes over the verbal KEY relation and binds its eventuality variable (y).

(20) *asp-op-rel*→
$$\begin{bmatrix} \text{HANDLE} & \textit{handle} \\ \text{EVY} & \textit{evy-ind} \\ \text{SCOPE} & \textit{handle} \\ \text{BEV} & \textit{evy-ind} \end{bmatrix}$$

(21) a. Paul allait à Paris.
'Paul was going to Paris.'

b.
$$\left\langle \begin{bmatrix} \textit{imp-rel} & \\ \text{HANDLE} & \boxed{0} \\ \text{SCOPE} & \boxed{1} \\ \text{BEV} & \boxed{x} \end{bmatrix}, \begin{bmatrix} \textit{prog-rel} & \\ \text{HANDLE} & \boxed{1} \\ \text{EVY} & \boxed{x} \\ \text{SCOPE} & \boxed{2} \\ \text{BEV} & \boxed{y} \end{bmatrix}, \begin{bmatrix} \textit{aller-rel} & \\ \text{HANDLE} & \boxed{2} \\ \text{EVY} & \boxed{y} \\ \text{ACT} & \text{Paul} \\ \text{DEST} & \text{Paris} \end{bmatrix} \right\rangle$$

3.1.2 Constraints on variable binding

The semantic representations presented in the preceding paragraph are intended to capture the idea that the verbal KEY relation (combined with its arguments) provides an eventuality description, that the aspectual operators provide functions from eventuality descriptions to eventuality descriptions, and that the tense relation is a relation between an eventuality description and a time.[15] Thus we can safely assume that every scopal expression outscoping the verbal relation binds an eventuality variable and provides another eventuality variable for binding.They are not sufficient however to make sure that aspectual operators must scope between the tense relation and the verbal KEY relation, since there is no real semantic type difference between the three sorts of relation.

However, to make sure that aspectual operators cannot take tenses in their immediate scope, it is sufficient to assume standard constraints on variable binding. These are stated in (22).

[14]This representation is simplified in that (i) proper names are treated as individual constants; and (ii) the PP complement of *aller* is taken to provide an argument to *aller-rel*, which is not the correct analysis for this type of PP complement; see Bonami (1999).

[15]An obvious question about this general approach is how quantified NPs fit in the picture. Although de Swart does not address this question, it is clear that quantified NPs can be taken to enter the semantic composition in the form of functions from relations between eventualities and individuals to eventuality descriptions (i.e., as quasi-aspectual operators of type $\langle\langle e, \langle e, t\rangle\rangle, \langle e, t\rangle\rangle$ with extra room for quantification over individuals). Two routes can then be taken to further specify the semantics of the NPs. Either we can derive the appropriate semantics by type-lifting from the usual generalized quantifier denotation for the NP, with the type lifting operator $\lambda\mathcal{Q}\lambda R\lambda e.\mathcal{Q}(\lambda x.R(e,x))$. Or we could assume that the denotation of natural language quantifiers cannot be derived from that of traditional generalized quantifiers, because they make a specific aspectual contribution. It remains to be seen whether this approach could shed new light on the aspectual impact of quantified NPs (Krifka, 1992, 1998; Verkuyl, 1993, 1999).

(22) Constraints on variable binding

a. For each relation r in the MRS of a sentence which has a BEV feature with value x, there must be a relation r' in the MRS which has an EVY feature with value x and which is outscoped by r.

b. For each relation r in the MRS of a sentence which has an EVY feature, there must be a relation r' in the MRS which has a BEV feature with value x and which outscopes r.

c. All instances of the BEV feature in a single MRS must take a distinct value.

These conditions make sure that no resolved MRS can verify a description such as (23), where the progressive operator takes widest scope: if the *prog-rel* takes the *imp-rel* in its scope, then the only variable available for both relations to bind is the EVY of *aller-rel*, $\boxed{x}$; but (22c) excludes this possibility.

(23)
$$\left\langle \begin{bmatrix} \textit{prog-rel} & \\ \text{HANDLE} & \boxed{0} \\ \text{EVY} & \textit{evy-ind} \\ \text{SCOPE} & \boxed{1} \\ \text{BEV} & \textit{evy-ind} \end{bmatrix}, \begin{bmatrix} \textit{imp-rel} & \\ \text{HANDLE} & \boxed{1} \\ \text{SCOPE} & \boxed{2} \\ \text{BEV} & \textit{evy-ind} \end{bmatrix}, \begin{bmatrix} \textit{aller-rel} & \\ \text{HANDLE} & \boxed{2} \\ \text{EVY} & \boxed{x} \\ \text{ACT} & \text{Paul} \\ \text{DEST} & \text{Paris} \end{bmatrix} \right\rangle$$

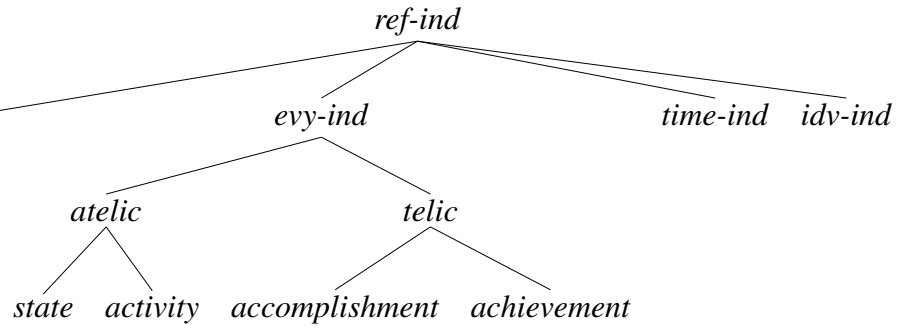
3.1.3 Aspectual selectional restrictions

Now that it has been guaranteed that no semantically impossible scoping of aspectual operators is licensed, it remains to be seen how aspectual selectional restrictions can be enforced. For instance, we need to be able to state that the representation in (24), which is the MRS equivalent of (5a), does not give rise to a well-formed reading.

(24)
$$\left\langle \begin{bmatrix} \textit{imp-rel} & \\ \text{HANDLE} & \boxed{0} \\ \text{SCOPE} & \boxed{1} \\ \text{BEV} & \boxed{x} \end{bmatrix}, \begin{bmatrix} \textit{aller-rel} & \\ \text{HANDLE} & \boxed{1} \\ \text{EVY} & \boxed{x} \\ \text{ACT} & \text{Paul} \\ \text{DEST} & \text{Paris} \end{bmatrix} \right\rangle$$

A number of different ways to block (24) can be conceived, depending on the detailed ontology one is willing to adopt for aspectual classification. If the aspectual classification is taken to be a classification of *eventualities* (as in de Swart (1998), *inter alia*), then it can be encoded directly in the grammar by typing the eventuality variables for aspectual class. Assuming a hierarchy of indices such as (25), the *imparfait* can be constrained to bind an atelic eventuality variable (26a), whereas *aller-rel* provides a telic one (26b). This would block the variable identification $\boxed{x}$ in (24).

(25)



(26) a. *imp-rel*→$\left[\text{BEV} \quad \textit{atelic}\right]$

b. *aller-rel*→$\left[\text{EVY} \quad \textit{telic}\right]$

However, it has been argued forcefully by Krifka (1992, 1998) that the aspectual classification does not apply to *eventualities* themselves, but only to eventuality *descriptions*. If one is to adopt the Krifkan view, it is not straightforward to encode selectional restrictions in the grammar, since MRS avoids combining descriptions directly.[16] Thus the simplest solution is not to encode the restrictions in the grammar at all, and to assume that the restrictions come into play only at the level of the *interpretation* of MRS representations.

In the remainder of this paper, I will adopt the first, simpler view of aspectual classification, where aspectual selectional restrictions are encoded directly in the grammar as constraints on eventuality indices. This choice is made purely for expository purposes.

3.2 Specifying the syntax/semantics interface

Now that a format for semantic representation has been defined, it remains to be seen how these representations are constrained by the grammar. Paragraph 3.2.1 discusses the grammar of tense and overt aspectual adjuncts; implicit aspectual operators are introduced in paragraph 3.2.2.

3.2.1 The grammar of tense and adjuncts

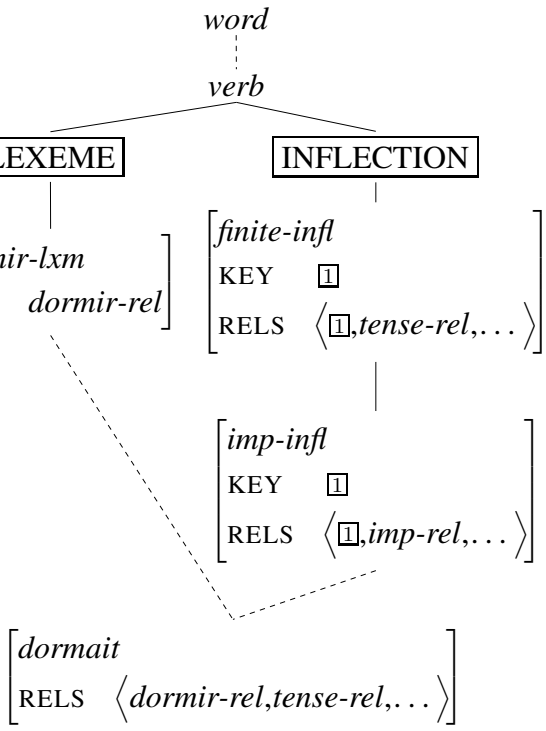
Under a lexicalist analysis of inflection, the semantic contribution of tense has to be provided at the level of the inflected head verb. The details of the analysis depend on the choice of a particular approach to inflection. Here I assume an approach in the style of Miller and Sag (1997); Abeillé et al. (1998), where inflected words are subject to a cross-classification along at least two dimensions, LEXEME and INFLECTION.[17] As illustrated in (27), as far as the semantics is concerned, lexemic types specify the KEY relation of individual word, whereas inflectional types specify which other relations occur on the word's RELS list. Thus tense relations are introduced as extra relations in a verb's semantic representation.[18]

[16] A way to encode the restrictions in the grammar would be to type the *handles* for aspectual class. Such a solution raises further difficulties, which would be too long to discuss here.

[17] One advantage of this approach is that it interacts nicely with the analysis of inflectional morphology proposed in Bonami and Boyé (2001).

[18] Notice that I leave it open that inflectional types license more relations on RELS; this will be used in paragraph 3.2.2.

(27)



What is left implicit in (27) is where the tense relation will scope. In this respect, a number of observations must be made. First, it is evident that the tense relation must not be allowed to take scope outside of its clause, since we do not want the tense of an embedded clause to be interpreted in its embedding clause. To account for this, I propose to use a new feature CLAUSE-TOP which indicates locally in each sign the scope of the highest scoping relation in the smallest scope this sign is a part of. That this is the case is ensured by the constraints in (28): the CLAUSE-TOP of a phrase is identical to that of all of its non-clause daughters, and the CLAUSE-TOP of a clause is its LOCAL-TOP.

(28) a. $\textit{headed-phrase} \rightarrow \begin{bmatrix} \text{CLAUSE-TOP} & \boxed{1} \\ \text{HD-DTR} & \begin{bmatrix} \text{CLAUSE-TOP} & \boxed{1} \end{bmatrix} \\ \text{NHD-DTRS} & \textit{list}(\begin{bmatrix} \textit{nonclause} \\ \text{CLAUSE-TOP} & \boxed{1} \end{bmatrix}) \bigcirc \textit{list(clause)} \end{bmatrix}$

b. $\textit{clause} \rightarrow \begin{bmatrix} \text{LTOP} & \boxed{1} \\ \text{CLAUSE-TOP} & \boxed{1} \end{bmatrix}$

One could then assume that the handle of the tense relation is identified with that of the CLAUSE-TOP. However, this is not quite correct, because some adjuncts must be allowed to outscope the tense relation. For instance, it is clear that to get a correct semantics for sentence adjuncts such as modals (29) or connectors (29), these must be assumed to take scope over tensed proposition, and thus over the tense relation.

(29) a. Paul allait probablement à Paris.
Paul go-IMP probably to Paris
'Paul was probably going to Paris.'
probably(imparfait(progressive(Paul-go-to-Paris)))

b. Paul rencontra donc Marie.
Paul meet-PS Marie
'Thus, Paul met Marie.'
thus(passé-simple(Paul-met-Marie))

Thus the tense relation cannot be taken to be scoped at the clause top in general: all that can be said is that the tense relation scopes somewhere between the CLAUSE-TOP and the KEY relation.

A second observation is that aspectually sensitive adjuncts (such as duration adverbials) take their scope between the tense relation and the KEY relation of the head verb; this is how the distribution of the tenses in (3) is accounted for.[19] What this data shows is that the tense relation always takes the verb's KEY relation in its scope, but not always in its *immediate* scope.

These two constraints are stated in (30), where "$\geq$" denotes the "equals or outscopes" relation between handles.[20]

(30) *finite-infl*$\rightarrow$
$$\begin{bmatrix} \text{KEY} & \boxed{0}\begin{bmatrix}\text{HANDLE} & \boxed{5}\end{bmatrix} \\ \text{CLAUSE-TOP} & \boxed{1} \\ \text{RELS} & \left\langle \boxed{0}, \begin{bmatrix} \textit{tense-rel} & \\ \text{HANDLE} & \boxed{2} \\ \text{SCOPE} & \boxed{3} \end{bmatrix}, \ldots \right\rangle \\ \text{H-CONS} & \left\{ \begin{matrix} \boxed{1} \geq \boxed{2} \\ \boxed{3} \geq \boxed{5} \end{matrix} \right\} \end{bmatrix}$$

[19]Notice that this is the case even when the adjunct is in clause-initial position. The following data is strictly parallel to the data in (3):

(i) a. Pendant une heure, Paul dormit.
For an hour Paul sleep-PS
'Paul slept for an hour.'
b. passé-simple(for-an-hour(Paul-sleep))

(ii) a. # Pendant une heure, Paul dormait.
For an hour Paul sleep-IMP
b. *imparfait(for-an-hour(Paul-sleep))

If the non-felicity of the *imparfait* in sentences with durative adverbials is explained by assuming that the *imparfait* takes the durative adverbial in its scope, then the same assumption should be made when the durative adverbial is in clause-initial position. This data shows that in a head-adjunct phrase, the KEY relation of the adjunct can be outscoped by some non-quantifier relation which is contributed by the head.

[20]Notice that we cannot rely on Copestake et al's (2000) "equality modulo quantifiers" relation, since adjuncts, and not only quantifiers, are allowed to scope between the CLAUSE-TOP and the tense relation, and between the tense relation and the KEY.

As for aspectually sensitive adjuncts themselves, it is sufficient to say that they too must scope between the CLAUSE-TOP and the KEY relation of the head verb. As an example, the following lexical entry can be assumed for the preposition *pendant*.

(31) *pendant*:

$$\begin{bmatrix} \text{HEAD} \mid \text{MOD} & \begin{bmatrix} \text{HEAD} & v \\ \text{KEY} & \begin{bmatrix} \text{HANDLE} & \boxed{5} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_{\boxed{6}} \right\rangle \\ \text{KEY} & \boxed{0} \\ \text{CLAUSE-TOP} & \boxed{1} \\ \text{RELS} & \left\langle \boxed{0} \begin{bmatrix} \textit{pendant-rel} & \\ \text{HANDLE} & \boxed{2} \\ \text{EVY} & \textit{telic} \\ \text{BEV} & \textit{atelic} \\ \text{SCOPE} & \boxed{3} \\ \text{DURATION} & \boxed{6} \end{bmatrix}, \ldots \right\rangle \\ \text{H-CONS} & \left\{ \begin{matrix} \boxed{1} \geq \boxed{2} \\ \boxed{3} \geq \boxed{5} \end{matrix} \right\} \end{bmatrix}$$

Constraining the *pendant-rel* to scope below the clause top ensures that the adjunct cannot scope out of its clause. Although this is not stated explicitly in (31), the adjunct will not be able to outscope the tense relation because of the constraints on variable binding discussed in paragraph 3.1.2: if the adjunct was to outscope the tense without exiting its clause, it would not be able to bind an eventuality variable, and thus the MRS would be ill-formed.

3.2.2 Implicit aspectual operators

In paragraph 2.4, it was observed that each implicit aspectual operator occurs in the immediate scope of some explicit item selecting for an eventuality description. I proposed to account for this property by postulating that each lexical item which takes an eventuality description as an argument can licence at most one implicit aspectual operator in its immediate scope. In the context of the present analysis, we can account for this by allowing verbs and aspectually sensitive adjuncts to take an extra implicit operator on their relation list. Under this analysis, finite inflections verify the description in (32), where *IAO-rel* is the type for a class of implicit aspectual operator relations.[21]

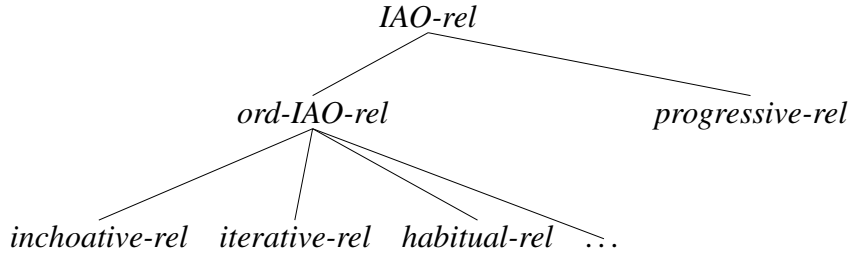
[21] It is assumed here that the implicit operator relation is genuinely optional. The disjunction in the description of the RELS list can be avoided by assuming that there is *always* an implicit operator, but that this operator can be the identity function on eventuality descriptions.

Notice that the description in (32) does not state explicitly that the implicit operator must outscope the KEY relation; the correct scoping is once again forced by the constraints on variable binding.

(32) *finite-infl*→
$$\begin{bmatrix} \text{KEY} & \boxed{0}\begin{bmatrix}\text{HANDLE} & \boxed{5}\end{bmatrix} \\ \text{CLAUSE-TOP} & \boxed{1} \\ \text{RELS} & \left\langle \boxed{0}, \begin{bmatrix} \textit{tense-rel} \\ \text{HANDLE} & \boxed{2} \\ \text{SCOPE} & \boxed{3} \end{bmatrix}, \left(\begin{bmatrix} \textit{IAO-rel} \\ \text{HANDLE} & \boxed{3} \end{bmatrix} \right) \right\rangle \\ \text{H-CONS} & \left\{ \begin{matrix} \boxed{1} \geq \boxed{2} \\ \boxed{3} \geq \boxed{5} \end{matrix} \right\} \end{bmatrix}$$

An obvious advantage of this analysis is that it allows individual inflectional types to control the identity of the implicit aspectual operators which can occur in their scope. As an example, it has been observed in paragraph 2.3 that the *imparfait*, but not the future tense, licenses a progressive operator in its scope. Assuming that implicit operator relations are organized in a hierarchy similar to (33), we can state directly that the class of operators licensed by the *imparfait* is larger than the class of those licensed by the future (34).[22]

(33)



(34) a. *imparfait-infl*→
$$\begin{bmatrix} \text{KEY} & \boxed{1} \\ \text{RELS} & \left\langle \boxed{1}, \textit{imp-rel}, (\textit{IAO-rel}) \right\rangle \end{bmatrix}$$

b. *future-infl*→
$$\begin{bmatrix} \text{KEY} & \boxed{1} \\ \text{RELS} & \left\langle \boxed{1}, \textit{future-rel}, (\textit{ord-IAO-rel}) \right\rangle \end{bmatrix}$$

3.3 Conclusion

In this paper, I have provided an HPSG analysis of tense and aspect in French. The analysis uses MRS to relate semantic representations inspired by de Swart's (1998) DRT analysis of tense and aspect to standard HPSG syntactic structures. The resulting view of the grammar of aspect has two key features.

First, it is strictly lexicalist: the tense relation of a finite clause originates on the semantic representation of the head verb, even when it gets scope over constituents other than the head verb;

[22]Notice that (34) licenses tense-operator combinations which will then be excluded on semantic grounds; for instance, the occurrence of an inchoative operator in the scope of the *imparfait* is not excluded by (34b), but will never give rise to a well-formed semantics, since the *imparfait* requires an atelic argument and the inchoative provides a telic one.

moreover, the use of MRS allows one to state directly appropriate grammatical constraints on the relative scope of tense and various types of adjuncts.

Second, implicit aspectual operators, which de Swart analyzes as coercion operators, are considered to be directly licensed by overt lexical items. This analysis has been shown to be empirically adequate in section 2: the coercion approach to implicit aspectual operators suffers from both under and over-generation, because it does not allow the statement of purely grammatical constraints on the occurrence of implicit operators. Moreover, this approach is theoretically more satisfying in making it unnecessary to enrich HPSG grammars with coercion operations.

In this paper, the general idea of using scope-underspecified semantic representations to account for grammatical constraints on aspectual composition has been applied only to a limited subclass of items entering aspectual composition: tenses, aspectual adjuncts, and implicit aspectual operators. Bonami (1999) applies the same approach to the aspectual impact of locative PP complements. Future research will tell whether such a general approach can shed new light on the analysis of the aspectual impact of NPs and aspectual verbs.

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