

Anaphoric temporal locators and discourse in Portuguese¹

ANA TERESA ALVES*

Abstract

Anaphoric temporal locators are referentially dependent expressions that supply the temporal location of the situation described by the sentence in which they occur. In spite of their syntactic and semantic variety, they all represent a time interval, whose definition depends on the linguistic context that precedes them, and inform on a broad range of temporal relations (e.g., forward sequencing, backward sequencing, or overlap) between the states of affairs described by their host sentence and by the sentence providing their referent. In addition, anaphoric temporal locators are, I propose, sensitive to cause-effect and mereological relations between situations. This has consequences for discourse structure, inasmuch as, along the lines of theories such as Segmented Discourse Representation Theory (SDRT), relations between situations play an important role in inference about discourse relations. Therefore, in order to account for these expressions, a framework involving the computation of discourse relations is needed. A proposal is made within SDRT.

¹ This paper presents the main ideas of my Ph. D. dissertation, entitled *Sobre a localização temporal adverbial anafórica em português*. As my dissertation has ca 350 pages and this paper around 30, much of what was written there had to be suppressed here. Anyone interested in having access to the complete version (written in Portuguese) can reach me at: ana.alves@notes.uac.pt.

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1. Introduction

In this paper, I shall discuss the semantics and pragmatics of anaphoric temporal locators (hereafter, ATLS). ATLS are expressions such as those in bold type in the following sequences:

- (1) A Maria visitou Paris em [1980]_i. Visitou Londres [**no mesmo ano**]_i.
'Maria visited Paris in [1980]_i. She visited London [**the same year**]_i.'
- (2) O Paulo chegou a casa [à meia-noite]_i. A Maria chegou [**antes disso**]_i.
'Paulo arrived home [at mid-night]_i. Maria arrived home [**before that**]_i.'
- (3) [A Maria chegou a Lisboa]_i n[o dia 12 de Maio]_i. O Paulo chegou [**na véspera desse dia**]_i.
'Maria arrived in Lisbon [on May 12th]_i. Paulo arrived [**the previous day**]_i.'
- (4) [A Maria chegou a Lisboa]_i no dia 12 de Maio. O Paulo chegara [**havia duas semanas**]_i.
'[Maria arrived in Lisbon]_i on May 12th. Paulo had arrived [**two weeks before**]_i.'

The expressions in bold type are anaphoric temporal adjuncts that temporally locate the eventuality described by the sentences in which they occur. They are anaphoric because the definition of the time interval they represent depends on the linguistic context that precedes them. If such a context does not exist, ATLS cannot be fully processed.

- (5) #A Maria visitou Londres **no mesmo ano**.
'#Maria visited London **the same year**.'
- (6) #A Maria chegou **antes disso**.
'#Maria arrived **before that**.'
- (7) #O Paulo chegou **na véspera desse dia**.
'#Paulo arrived **the previous day**.'
- (8) #O Paulo chegara **havia duas semanas**.
'#Paulo had arrived **two weeks before**.'

Directly or indirectly, ATLS communicate a wide range of temporal relations between (in the cases under study here) two eventualities. For instance, in (2), by stating that Maria arrived home at a time prior to the time of Paul's arrival,

the speaker communicates that Maria arrived home before Paulo; in (4) the ATL expresses that the eventuality of Paul's arrival occurred at a time that lies at a distance of two weeks in the past from the eventuality of Ana's arrival, that is, Paulo arrived two weeks before Ana.

As we are dealing with anaphora in the temporal domain, proper anaphoric antecedents are provided by expressions that directly represent time, that is, time denoting expressions. See the underlined expressions below:

- (9) A Maria licenciou-se em Junho. O Paulo também se licenciou nesse mês.
'Maria graduated in June. Paulo graduated in that month too.'
- (10) A Maria perdeu o autocarro na segunda-feira passada. Chegou tarde à escola nesse dia.
'Maria missed her bus last Monday. She arrived late at school that day.'

However, as in other domains, also here there are cases in which the antecedent is not directly represented in the linguistic context but is somehow inferred from it. In the sequences below, the necessary anaphoric antecedents cannot be underlined as in the previous examples, because they are not represented by any of the expressions in the linguistic context preceding the anaphor:

- (11) O Paulo assaltou um banco. Foi preso no mesmo dia.
'Paulo robbed a bank. He was arrested the same day.'
- (12) A Maria saiu de casa por volta das 15h e regressou cerca das 19h. Assaltaram-lhe a casa entretanto.
'Maria left home around 3 pm and returned about 7 pm. In the meantime, someone robbed her house.'

In these cases, the eventuality descriptions *o Paulo assaltou um banco* (Paulo robbed a bank) and *a Maria saiu de casa por volta das 15h e regressou cerca das 19h* (Maria left home around 3 pm and returned about 7 pm), despite not representing time directly, supply the necessary temporal antecedent. I shall elaborate on this point further in section 3.5.

2. Previous research

Temporal locating adverbials have been studied in several works (e.g., Smith 1980, Lo Cascio 1986, Hinrichs 1981 and 1986, Borillo 1983, Kamp and Rohrer 1983, Bras 1990 and Asher *et al.* 1995). In all cases, the authors refer to the existence of anaphoric adverbials. Due to space constraints, I will

briefly describe the proposals presented only in Borillo 1983 (adopted by Bras 1990) and Kamp and Rohrer 1983, without elaborating on what is said in the remaining works.

Borillo 1983 distinguishes four classes of temporal locators with respect to their referential (in)dependence: autonomous, deictic, anaphoric and polyvalent. Concerning the anaphoric locators, the author claims that:

«Ils ne sont interprétables que si une référence temporelle a été déjà établie, sur laquelle un calcul chronologique peut être effectué en termes d'antériorité, de simultanéité ou de postériorité.» (Borillo 1983: 111)

The author gives the following examples: *à ce moment-là* (nesse momento / at that moment), *ce matin-là* (nessa manhã / that morning), *depuis la veille* (desde a véspera / since the day before), *la veille* (na véspera / the day before), *dix ans plus tôt* (dez anos mais cedo / ten years earlier), *le jour même* (no mesmo dia / the same day), *le lendemain* (no dia seguinte / the following day), *le mois suivant* (no mês seguinte / the following month), *trois jours après* (três dias depois / three days after), and the sequential *puis* (depuis / afterwards), *ensuite* (em seguida / next) and *auparavant* (antes / beforehand). As will be explained below, I do not agree with Borillo's claim that anaphoric expressions relate to a previously introduced mark by means of a chronological relation that can express anteriority or posteriority. My proposal is that the relation between the anaphor and the mark on which its interpretation depends is always an identity relation. This is true even for locators like *trois jours après* (três dias depois / three days after) and *la veille* (na véspera / the day before), which I analyse as having a null anaphoric complement, represented below as $\emptyset_{de\ t^a} / \emptyset_{t^a}$ – where subscripted 't^a' indicates that the complement is temporal and anaphoric, and subscripted 'de' indicates the preposition subcategorised by *veille*, *véspera* and *depuis*. It is, I claim, between that null complement and the antecedent that the anaphoric relation is established.

(13) Maria est arrivée le 15 Juin. Paulo est arrivé {trois jours après $\emptyset_{de\ t^a}$ / la veille \emptyset_{t^a} }.

A Maria chegou no dia 15 de Junho. O Paulo chegou {três dias depois $\emptyset_{de\ t^a}$ / na véspera \emptyset_{t^a} }.

'Maria arrived on June 15th. Paulo arrived {three days after / the day before}.'

A second comment on Borillo's work concerns the classification of locators such as *la veille*, *trois jours après*, and *le mois suivant* as anaphoric. My proposal is that ATLs with relational expressions like *veille* / *véspera*, *après* / *depuis* and *suivant* / *suivante*, depending on the referential properties of the complement of these expressions, may also occur as autonomous. Consider the sequence below:

- (14) Paulo est arrivé à Paris {trois jours après / la veille de} mon départ.
 O Paulo chegou a Paris {três dias depois / na véspera} da minha partida.
 ‘Paulo arrived in Paris {three days after / the day before} my departure.’

Here, the complement of *trois jours après / três dias depois* and *la veille de / na véspera de* is an autonomous expression. In (13) above, its complement is arguably a null anaphoric expression. Accordingly, the ATL is anaphoric in (13) and autonomous in (14), which means that expressions like *la veille de ... / na véspera de...* and *trois jours après... / três dias depois de...* and others involving relational expressions should be classified as polyvalent.

Kamp and Rohrer 1983 present four groups of temporal adverbials:

- (15) *hier, aujourd'hui, demain*
ontem, hoje, amanhã
yesterday, today, tomorrow
- (16) *maintenant, dans 2 heures, jusqu'ici, en ce moment*
agora, dentro de 2 horas, até aqui, neste momento
now, in two hours, until now, at this moment
- (17) *deux jours après, un an plus tard, à ce moment, alors*
dois dias depois, um ano mais tarde, nessa altura, então
two days after, one year later, at that time, then
- (18) *depuis deux jours, à partir de deux heures*
desde há dois dias, a partir das duas horas
since two days ago, from two o'clock on

The authors dub the locators in (17) “anaphoric expressions *par excellence*” and make the following observation:

"These adverbs are anaphoric expressions *par excellence*. The principles according to which the context determines the relevant denotations for such adverbs appear to be very similar to those which govern the reference of anaphoric third person personal pronouns."
 (Kamp e Rohrer 1983: 263)

Such “anaphoric expressions *par excellence*” are explicitly distinguished from the ATLs in (16), which may also depend on the linguistic context. Starting with the connection between (19a) and (19b) below, the authors explain that, regarding *deux jours après* (dois dias depois / two days after), “the time *t* it denotes must be two days after some other time *t'* which context provides. But any contextually salient time or event can serve as *t'*, and there are no

restrictions on tense forms with which the expression can combine” (cf. Kamp and Rohrer 1983: 263).

- (19) a Kissinger arriva au Caire le 6 juillet.
 b. Deux jours après il partit pour Jérusalem.
 c. *Dans deux jours il partit pour Jérusalem.

In contrast to this, *dans deux jours* (dentro de dois dias / in two days), which appears in (19c), “can only denote a time two days after either the speech point or the reference point. Second, it always signifies a looking forward in time from the anchor point (i.e. speech point or reference point) and for that reason is compatible only with those tense forms which convey a similar forward looking temporal orientation” (*ib.*).

The difference just presented leads me to conclude that Kamp and Rohrer 1983 make a distinction between two types of referential dependency on the previous linguistic context: (i) with an anaphora dependent on the reference point (that in Kamp and Reyle 1993 will be called Temporal Perspective Point (TPpt)), and (ii) with an anaphora of the pronominal type. Based on this division, I shall distinguish in section 3.1. between two subclasses of ATLS: ATLS dependent on a time that can be different from the TPpt and ATLS dependent on a TPpt.

3. Diversity of ATLS

3.1. ATLS and different anaphoric dependencies

Regarding their computation mode, we can distinguish between two major types of ATLS: ATLS involving the computation of a referentially dependent expression in their complement and ATLS that do not have an anaphoric complement but still involve a dependence on an anaphoric TPpt. Within the first class, two subclasses may be distinguished: the class of ATLS depending on a time that can be different from the TPpt and the class of those depending on a TPpt that cannot be lexically realized. The following *two groups of examples* illustrate, respectively, these two subclasses:

- (20) A Maria licenciou-se em 1999. Mudou-se para Paris depois disso.
 ‘Maria graduated in 1999. She moved to Paris after that.’
- (21) O muro de Berlim caiu em 1988. Eu fui a Berlim nesse ano.
 ‘The Berlin Wall fell in 1988. I went to Berlin that year.’
- (22) O Paulo foi a Londres em 2000. A Maria fora lá recentemente.
 ‘Paulo went to London in 2000. Maria had been there recently.’

- (23) O Paulo visitou Londres em 2000. A Tate Modern fora inaugurada havia duas semanas.
 ‘Paulo visited London in 2000. The Tate Modern had been inaugurated two weeks before.’

Recentemente (recently) and *havia duas semanas* (two weeks before) represent time intervals whose definition involve the TPpt, which, in the cases presented, is provided by the linguistic context. As the TPpt depends on the verbal tense form used in the sentence, in their anaphoric uses these expressions always occur with tenses not relating to the speech time as, for instance, the *pretérito mais-que-perfeito* (pluperfect) (cf. (22) and (23)).

The following two examples, illustrate the second major class of ATLS:

- (24) O Paulo mudou-se para Nova Iorque em 1992. Ficaria nos EUA até 2001.
 ‘Paulo moved to New York in 1992. He would stay in the USA until 2001.’
- (25) O Paulo mudou-se para Nova Iorque em 1992. Vivia em Austin desde 1980.
 ‘Paulo moved to New York in 1992. He had been living in Austin since 1980.’

This second class contains the locators headed by *até / until* and *desde / since*. As the examples show, although their complement is not anaphoric, there is still a referential dependence on the linguistic context. As was noticed in the literature (cf. Asher et al. 1995 and Mória 2000, for instance) temporal locators headed by *since / desde* and *until / até* represent time intervals of which only one temporal boundary is explicitly mentioned – the initial boundary in the case of *since* and the final one in the case of *until*. The boundaries that are not explicitly mentioned are defined from the TPpt. In the examples above, the eventuality descriptions in the first sentence of each sequence provide the TPpt from which these boundaries are defined.

3.2. Syntactic diversity of ATLS

Along the lines of Kamp and Reyle 1993 and Mória 2000, I am assuming that temporal locators have one of the following structures:

- (i) temporal operator + complement
 (*em 1980 / in 1980, desde então / since then*);
- (ii) temporal operator₁ + complement + temporal operator₂ + complement
 (*desde Janeiro até Setembro / from January until September, de Maio a Julho / from May to July*).

Temporal operators are typically prepositions or conjunctions, and can be simple or complex. I am assuming that, as proposed in Kamp and Reyle 1993 and Mória 2000, temporal operators can be null – cf. *(em) este fim-de-semana* (this weekend) and *(em) este Sábado* ((on) this Saturday) and sometimes must be null (cf. *ontem* (yesterday) and *hoje* (today)).

The complement part of ATLs corresponds to an expression (directly or indirectly) representing a time interval. Such expressions present a considerable syntactic variety and different degrees of complexity, falling at least under the following patterns:

(i) noun phrases

esse ano / that year, a altura / the time, o mesmo dia / the same day, esse meio tempo / the meantime, esses dois dias / those two days

(ii) proforms

então / then aí / then, ali / then, lá / then, isso / that, isto / this, entretanto / meanwhile

(iii) adverbial phrases

posteriormente (a isso) / later, anteriormente (a isso) / previously, recentemente / recently, ultimamente / lately

(iv) prepositional phrases

antes disso / before that, depois disso / after that

In spite of their syntactic diversity, these expressions include anaphors such as a demonstrative pronoun (e.g., *esse ano / that year*), a definite article (e.g., *a altura / the time*) or a temporal proform (e.g., *então / then*). In other cases, the anaphor can be null (e.g., *anteriormente / previously*). It can also be the case that the complement is a referentially dependent adverb (e.g., *recentemente / recently, ultimamente / lately*)

Regarding their complexity, expressions occurring as complements of ATLs can be simple, like, for instance, *então* or *lá* (then), or complex, like *a véspera desse dia* (the day before that day), *o dia seguinte ao desse importante acontecimento* (the day after the day of that important event), for instance. The latter involve an expression whose complement can also be a complex expression. The anaphor which gives the ATL its anaphoric meaning can occur in any of the three positions presented in (i)-(iii) below:

(i) Complement of temporal operator (t_c^a)

em	+	essa altura (cf. <i>nessa altura / at that time</i>)
enquanto	+	isso (cf. <i>enquanto isso / meanwhile</i>)
desde	+	então (cf. <i>desde então / since then</i>)

(ii) Complement of t_c^a (t_{cc}^a)

- \emptyset_{em} + antes de + isso (cf. *antes disso* / *before that*)
 \emptyset_{em} + depois de + isso (cf. *depois disso* / *after that*)
 em + a véspera de + esse dia (cf. *na véspera desse dia* / *the day before that day*)

(iii) Complement of t_{cc}^a (t_{ccc}^a)

- desde + antes de + a semana anterior a + a semana desse importante acontecimento (cf. *desde antes da semana anterior à (semana) desse importante acontecimento* / *since before the week preceding the week of that important event*)
 até + depois de + o dia seguinte a + (o dia de) essa revolução (cf. *até depois do dia seguinte a (o dia de) essa revolução* / *until after the day following the day of that revolution*)

Complex locators – cf. examples in **(ii)** and **(iii)** – are those whose complement has a relational expression, usually a noun, an adjective, an adverbial, a conjunction or preposition, like, for instance, *seguinte* (following), *anterior* (previous), *mesmo* (same), or *véspera* (the day before), *anteriormente* (previously), *antes* (before), *depois* (after). Locators with these expressions are anaphoric if and only if these expressions have anaphoric complements (cf.(26)). Otherwise, they are autonomous (cf. (27)).

- (26) a. A Maria chegou a Berlim no dia da Queda do Muro.
 ‘Maria arrived in Berlin the day of the Fall of the Wall.’
 b. O Paulo chegou na véspera.
 ‘Paulo arrived the previous day.’
 c. O Paulo chegou dois dias antes.
 ‘Paulo arrived two days before.’
 d. O Paulo chegou dois dias depois.
 ‘Paulo arrived two days after.’
 e. O Paulo chegou dois dias depois desse importante acontecimento.
 ‘Paulo arrived two days after that important event.’
- (27) a. A Maria chegou a Berlim na véspera da Queda do Muro.
 ‘Maria arrived in Berlin the day before the Fall of the Wall.’
 b. A Maria chegou a Berlim dois dias antes da Queda do Muro.
 ‘Maria arrived in Berlin two days before the Fall of the Wall.’
 c. A Maria chegou a Berlim dois dias depois da Queda do Muro.
 ‘Maria arrived in Berlin two days after the Fall of the Wall.’

3.3. Semantic diversity of ATLS

Within the domain of ATLS, a relevant semantic distinction must be drawn between strictly anaphoric locators and ambivalent locators. Strictly anaphoric locators always depend on the linguistic context. It is the case of *naquele ano* (that year), *nesse mês* (that month), *na mesma semana* (the same week), *no ano seguinte a esse* (the following year), *havia duas semanas* (two weeks before), for instance; as for ambivalent locators, in some cases they depend on the linguistic context and in other cases on another time value. Concerning ambivalent locators depending on a TPpt that cannot be lexically realized, it is worth noticing that they are deictic-anaphoric, that is, they can occur both in deixis (cf. (28)) and in anaphora contexts (cf. (29)). It is the case, for instance, of *recentemente* (recently) and *há duas semanas* (two weeks ago or two weeks before).

(28) O Paulo visitou Londres {recentemente / há duas semanas}.
‘Paulo visited London {recently / two weeks ago}.’

(29) O Paulo visitou Londres em 2000. A Tate Modern fora inaugurada {recentemente / há duas semanas}.
‘Paulo visited London in 2000. The Tate Modern had been inaugurated {recently / two weeks before}.’

As regards locators dependent on a time value different from the TPpt, cases of ambivalence are confined to locators involving the demonstrative *este* (this) and to locators with relational expressions. The latter are anaphoric when their complement is anaphoric and autonomous when their complement is autonomous (cf. (26) and (27) above, and (30)-(31)).

(30) A Maria vai a Paris este fim-de-semana.
‘Maria is going to Paris this weekend.’

(31) O Paulo visitou Paris no último fim-de-semana de Agosto. A Maria foi a Londres neste fim-de-semana.
‘Paulo visited Paris on the last weekend of August. Maria went to London that weekend.’

Another relevant distinction exists between locators with predicative content, like *no mesmo ano* (the same year), *nesse dia* (that day), *nesta semana* (this week) and locators without predicative content, such as *então* (then), *depois disso* (after that), *entretanto* (in the meantime). The two classes include an anaphora identity condition in the semantic representation.

Additionally, the former include one or more predicative conditions such as, for instance and in the simplest cases, [day(t)], [year(t)]. The former constrain the expression providing their antecedents to describe a certain calendar unit (day, month, year, etc.), whereas the latter somehow under-specify their antecedents. This means that (at least some) locators without predicative content may pick up discourse referents introduced by time denoting expressions and discourse referents inferred from situation descriptions, giving rise to ambiguous cases. See the following examples:

- (32) A Maria chegou a casa cerca da meia-noite. O Paulo chegou depois disso.
 ‘Maria arrived home around midnight. Paulo arrived after that.’
- (33) O Paulo foi a Paris em 1980. A Maria foi então a Londres.
 ‘Paulo visited Paris in 1980. Maria visited London then.’

These examples are ambiguous with respect to the anaphoric antecedent of the temporal locators. In (32), *depois disso* (after that) can refer back to the discourse referent introduced by *cerca da meia-noite* (around midnight) or to the discourse referent supplied by the eventuality of Mary’s arriving home. Similarly, in (33) *então* (then) can refer back to the discourse referent introduced by *1980* or to the discourse referent representing the running time of the eventuality described in the first sentence. In other words, what (33) communicates is that Mary visited London while John visited Paris or else that Mary visited London in the same year that John visited Paris. World-knowledge and discourse structure can disambiguate most of the cases involving these locators. See the following examples:

- (34) O Paulo visitou Paris em 1980. Viu então a Mona Lisa.
 ‘Paulo visited Paris in 1980. He saw the Mona Lisa then.’
- (35) O Paulo visitou Paris em 1980. Tinha vinte anos na altura.
 ‘Paulo visited Paris in 1980. He was 20 years old at the time.’
- (36) A Maria teve um acidente de viação em 1980. Deixou de conduzir depois disso.
 ‘Maria had a car accident in 1980. She quit driving after that.’

In these sequences, the anaphoric locators – *então* (then), *na altura* (at the time) and *depois disso* (after that) – refer back to the time interval corresponding to the running time of the eventuality described in the first sentence of each sequence. The other readings – according to which they

would refer back to the time interval denoted by *1980* – are not available because they are incompatible with the discourse relations that hold between the two segments in each sequence – Elaboration in (34), Background in (35), and Result in (36). These discourse relations have impact on the temporal relations holding between the two relevant eventualities: in the first case, the second eventuality is temporally included in the first; in the second case, the second eventuality includes the first; in the third case, there is temporal abutment between the two eventualities. Accordingly, the anaphoric locators have to be interpreted as relating to the running time of the eventualities.

In spite of the wide syntactic and semantic variety of ATLs, they all share in common the representation of a temporal interval whose definition is dependent on the linguistic context preceding the locator and the expression of a temporal relation between (in the cases under study here) two eventualities.

3.4. Formal representation within DRT

In this section I give the formal representations of the locators under study. These representations are made within Discourse Representation Theory (cf. Kamp and Reyle 1993 and Mória 2000). Due to space restrictions, the DRS construction rules will not be formulated. For each of the two subtypes of locators presented before, only two DRSs will be displayed.

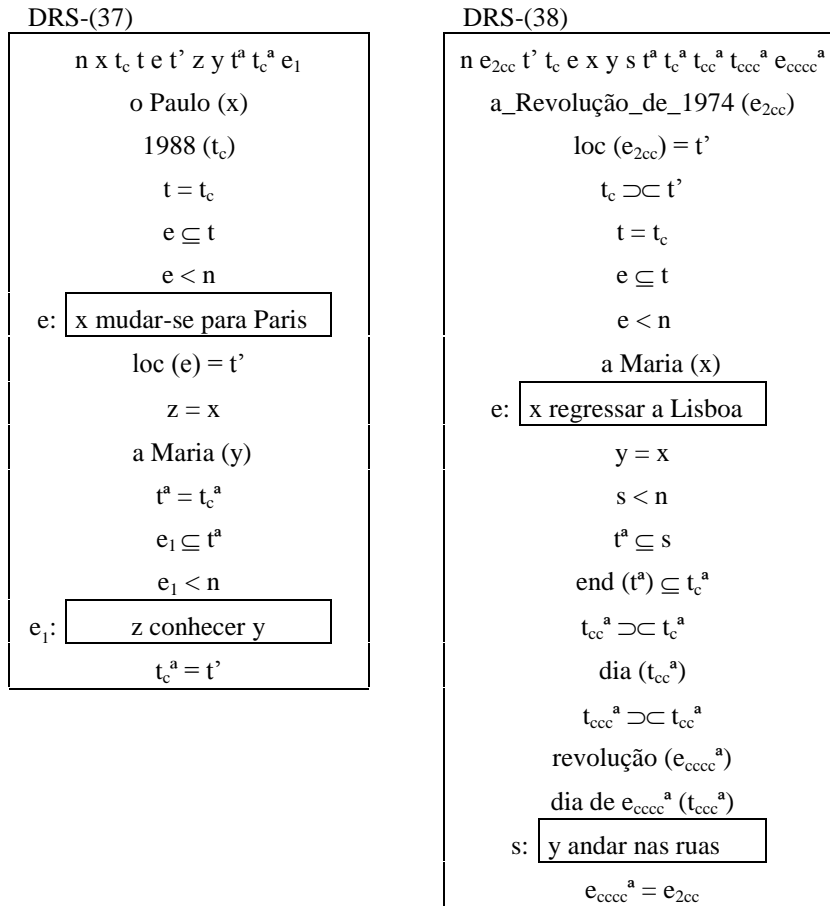
I shall start with the representations of locators of the first subtype, those involving an anaphoric expression in their complement. All ATLs introduce in the semantic representation the following elements: (i) a new discourse referent of type *t*; (ii) an identity condition of type ‘*t*=?’; (iii) depending on the locator, predicative conditions as, for instance [day(*t*)], [week(*t*)]. See below the representation of the following sequences:

- (37) O Paulo mudou-se para Paris em 1988. Conheceu a Maria nessa altura.

‘Paulo moved to Paris in 1988. He met Maria at that time.’

- (38) A Maria regressou a Lisboa antes da Revolução de 1974. Andou nas ruas até depois do dia seguinte a (o dia de) essa revolução.

‘Maria returned to Lisbon before the 1974 Revolution. She walked in the streets until the day after (the day of) that revolution.’



In DRS (37), it is worth noticing that the anaphor corresponds to the complement of the temporal operator (*essa altura*) and is represented by [$t_c^a = t'$]. With respect to the second DRS (cf. DRS-(38)), notice that the anaphor (*essa*) occurs embedded in the noun phrase corresponding to t_{ccc}^a . In the DRS, this NP (*essa revolução*) is represented by the discourse referent e_{cccc}^a . Its anaphoric meaning is indicated in the respective discourse referent by ^a.

Let us now turn to the representation of ATLs of the second major type, those with *desde / since* and *até / until* in the sequences below:

- (39) O Paulo mudou-se para Paris em 1990. Vivia em Lisboa desde 1980.
 'Paulo moved to Paris in 1980. He had been living in Lisbon since 1980.'

- (40) O Paulo mudou-se para Nova Iorque em 2002. Ficaria nos Estados Unidos até 2005.
 ‘Paulo moved to New York in 2002. He would stay in the United States until 2005.’

In DRT terms, and as it occurs in the cases presented before, the anaphoric dependence of the adverbial expressions implies a choice of an appropriate discourse referent from those already present in the DRS universe. According to Kamp and Reyle (1993: 604), such choice is limited to discourse referents for events and times:

“[This time the step involves choosing for the TPpt some discourse referent other than n.] As with Rpts we stipulate that the choice is restricted to discourse referents for events and for times.”

See below the (simplified) representations.

DRS-(39)	DRS-(40)
$n \ x \ t_c \ t \ e \ y \ t'' \ t_{2c} \ s$ o Paulo (x) 1990 (t_c) $t = t_c$ $e \subseteq t$ $e < n$	$n \ x \ t_c \ t \ e \ y \ t'' \ t_{2c} \ s$ o Paulo (x) 2002 (t_c) $t = t_c$ $e \subseteq t$ $e < n$
e: x mudar-se para Paris	e: x mudar-se para Nova Iorque
$y = x$ $TPpt := loc(e)$ $s \circ TPpt$ $t'' \subseteq s$ 1980 (t_{2c}) $beg(t'') \subseteq t_{2c}$ $end(t'') = TPpt$	$y = x$ $TPpt := loc(e)$ $TPpt < s$ $t'' \subseteq s$ 2005 (t_{2c}) $end(t'') \subseteq t_{2c}$ $TPpt \supseteq beg(t'')$
s: y viver em Lisboa	s: y ficar nos EUA

3.5. *Diversity of anaphora: anaphora with explicit antecedents and anaphora with inferred antecedents*

As pointed out by several authors (e.g., Kamp and Reyle 1993, and Glasbey 1994), it is not always the case that an anaphoric antecedent is directly represented in the linguistic context that precedes the anaphor. Compare sequences (41)-(42) below to sequences (43)-(44):

- (41) Mary owns a donkey. She loves it.
A Mary possui um burro. Ela ama-o.
(cf. Kamp e Reyle 1993: 215)
- (42) Daniel climbed Ben Nevis in July. Gareth climbed Snowdon then.
O Daniel escalou o Ben Nevis em Julho. O Gareth escalou então o Snowdon.
(cf. Glasbey 1994: 5)
- (43) Fred admires Susan. They are writing a paper on plurals.
O Fred admira a Susan. Eles estão a escrever um artigo sobre plurais.
(cf. Kamp e Reyle 1993: 341)
- (44) Daniel climbed Ben Nevis. Gareth was climbing Snowdon at the time.
O Daniel escalou o Ben Nevis. O Gareth estava a escalar o Snowdon na altura.
(cf. Glasbey 1994: 5)

In (41) and (42), *it* and *then* relate to *a donkey* and *June*, respectively. In (43) and (44), *they* and *the time* refer back, respectively, to the plural entity formed by Fred and Susan and to the running time of the situation *Daniel climbed Ben Nevis*. What is important to notice is that these latter entities are not represented in the linguistic context in a direct way, but are instead construed from that context. We may say that sequences (41) and (42) are cases of classical anaphora and (43) and (44) are cases of anaphora with inferred antecedents. In this section I'll show the existence of new cases of anaphora with inferred antecedents in the temporal domain.

For Kamp and Reyle 1993, anaphora is understood as a relation “between pronouns and discourse referents that are already present in the semantic representation under construction” (cf. p. 67). Along the lines of DRT, in this paper, I understand anaphora as a relation between a temporal proform and a discourse referent already present in the DRS universe. As we are dealing with temporal anaphora, that is anaphora involving temporal entities, the relevant discourse referents are those of type *t*. Still according to the same authors, two types of expressions introduce *t* referents in a semantic representation: time-denoting expressions and – via a function **loc** – eventuality descriptions. In their terms, **loc** assigns to an eventuality the interval of time it occupies (cf. p. 608). In other words, only time-denoting expressions directly introduce

discourse referents of type t in a DRS, while eventuality descriptions do it indirectly. What the function **loc** does is to account for the deduction of time intervals from eventuality descriptions, in this particular case the time interval the eventuality occupies. I adopt the same view: time-denoting expressions denote time, eventuality descriptions supply time.

In accordance with what was said above, the examples below are unproblematic with respect to the question of finding an antecedent for the anaphoric expression.

- (45) O Paulo foi a Paris em Dezembro de 1999. A Maria foi a Londres nesse ano.

‘Paulo went to Paris in December 1999. Maria went to London that year.’

- (46) O Paulo foi a Paris em Dezembro de 1999. Foi a Londres no mesmo mês.

‘Paulo went to Paris in December 1999. He went to London the same month.’

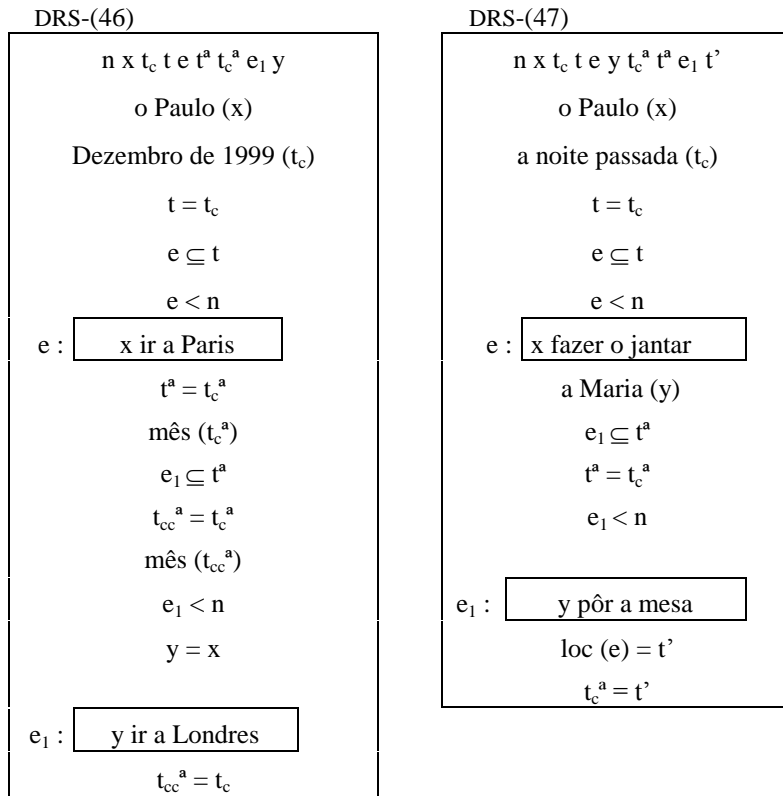
- (47) O Paulo fez o jantar a noite passada. A Maria pôs a mesa entretanto.

‘Paulo cooked dinner last evening. In the meantime Maria set the table.’

- (48) A Maria esteve hospitalizada. A mãe tomou-lhe conta do bebé durante esse tempo.

‘Maria was hospitalised. Her mother looked after her baby during that time.’

At the point where we have to complete the equation condition [$t_c^a = ?$], the DRS already contains the discourse referent representing the intended antecedent. In the first two cases, the antecedent discourse referent was introduced by *1999*; in the last two cases (a case of anaphora with inferred antecedents), the necessary antecedents were introduced in the DRS by means of the function **loc**. For the sake of illustration, the DRSs representing (46) and (47) are given below:



In contrast to sequences (47)-(48), presented above, in examples such as (49)-(50) the anaphoric antecedent is not directly represented in the linguistic context. It cannot be introduced in the DRS via the *loc* function as in (47)-(48), for in this case the anaphor does not refer back to the time interval corresponding to the “running time” of an eventuality.

(49) O Paulo escreveu uma carta à Maria. Ela respondeu-lhe na mesma semana.

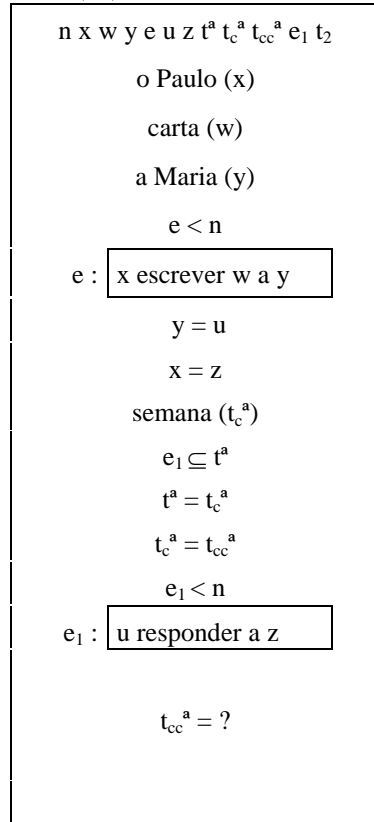
‘Paulo wrote Maria a letter. She answered him the same week.’

(50) A Maria teve um furo na semana passada. Foi a pé para a escola nesse dia.

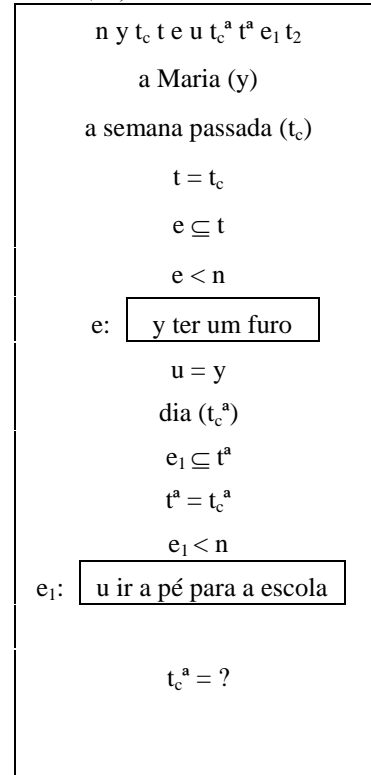
‘Maria had a flat tyre last week. She walked to school that day.’

As shown in the DRSs below, in the first case there is no discourse referent corresponding to the week in which Paulo wrote to Ana, and, in the second, a discourse referent representing the day when Maria had a flat tyre is missing.

DRS-(49)



DRS-(50)



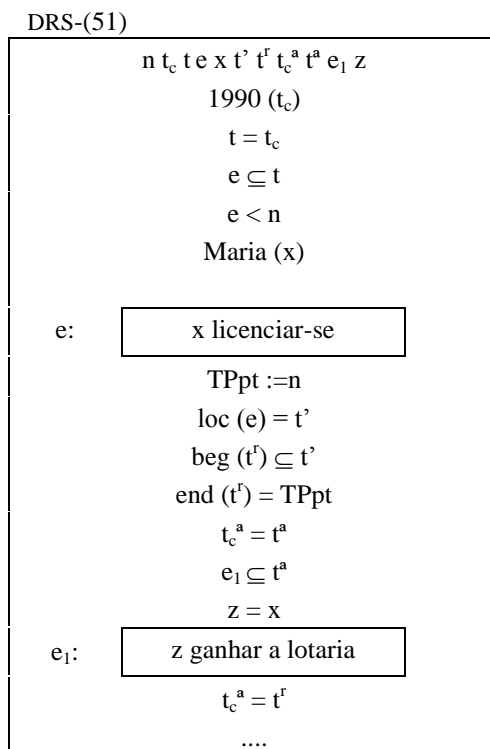
In these cases the anaphor refers back to a calendar time interval in which an eventuality is located. What seems to be the case here is that from an eventuality description a calendar time interval that contains it is inferred. To account for this inference and to introduce in the DRS the necessary antecedent discourse referent, another function is required, indeed a group of functions. A function that assigns to an eventuality the day when it occurred, another function to assign to it the week in which it happened, a third one to assign an eventuality the month in which it took place, and so on. Via these functions, the system is now able to introduce in the DRSs the discourse referents corresponding to the day in which Maria had a flat tyre and the week when Paulo wrote Maria a letter.

... t_2 t_2 ...
s-loc (e) = t_2	d-loc (e) = t_2
semana (t_2)	dia (t_2)
$e \subseteq t_2$	$e \subseteq t_2$

Let us now observe a third group of cases. In (51)-(53) below, again the antecedent discourse referent is not directly represented in the linguistic context preceding the anaphor, but the picture has different characteristics. In fact, in these cases the anaphor refers back to a time interval whose boundaries are provided by the linguistic context (and in some cases also by the utterance time), although that interval is not directly represented in the same linguistic context.

- (51) A Maria licenciou-se em 1990. Entretanto, ganhou a lotaria e abandonou a carreira.
 ‘Maria graduated in 1990. In the meantime, she won the lottery, and gave up her career.’
- (52) A escola só contratará um novo professor em 2008. {Entretanto / enquanto isso / nesse meio tempo}, a Maria dá as aulas à turma A.
 ‘The school will only hire a new teacher in 2008. In the meantime Maria will be teaching group A.’
- (53) O Paulo deixou Lisboa em Julho e regressou em Setembro. {Entretanto / neste meio tempo}, um ladrão assaltou-lhe a casa.
 ‘Paulo left Lisbon in July and returned in September. In the meantime a burglar broke into his house.’

In (51) the anaphors *entretanto* and *the meantime* refer back to time intervals whose right boundary is the TPpt (here the speech time) and whose left boundary is defined by the eventuality described in the first clause. In (52), it is the right boundary that is provided by the linguistic context, the TPpt (speech time) providing the left boundary. In (53), both boundaries are provided by situation descriptions. In other words, in these cases we infer time intervals from temporal boundaries. For the sake of illustration, see the partial DRS representing (51).



Interestingly, not all ATLs occur in all three types of indirect anaphora referred to in (51)–(53). See Table 1:

Subtypes of anaphora	Portuguese ATLs
<i>anaphora depending on the TP_{PT} in the final boundary</i>	<i>entretanto, este meio tempo</i>
<i>anaphora depending on the TP_{PT} in the initial boundary</i>	<i>entretanto, enquanto isso, o meio tempo</i>
<i>anaphora not depending on the TP_{PT}</i>	<i>entretanto, o/este/esse/aquele meio tempo, nesse tempo, durante esse tempo, enquanto isso</i>

Table 1. ATLs intervening in anaphora involving the inference of time intervals from temporal boundaries

As can be seen, each type of anaphora selects a certain group of possible ATLs. For instance, *entretanto* can be used in all three cases, whereas *enquanto isso* can only be used in two.

4. ATLS as replacing anaphoras

Molinés (1989: 14, *apud* Bras 1990: 100) proposes a distinction between three types of anaphora concerning the relation between the anaphor and its antecedent:

“Le repère nécessaire à l’interprétation des adverbes anaphoriques, appelé antécédent anaphorique, est en général déterminé par le discours précédent. On peut distinguer plusieurs types d’anaphores en étudiant les liens entre l’antécédent et l’objet de l’anaphore:

- anaphore substitutive: *le 1er janvier ...ce jour là*,
- anaphore relationnelle: *le 1er janvier ...le lendemain*,
- anaphore méronomique: *ce jour là ...le matin*”.

As far as we can conclude from what the author says, replacing cases (cf. “anaphore substitutive”) are those where there is co-reference between the anaphor and its antecedent (cf. *le 1er janvier ...ce jour là*). In the other two cases, the link between the anaphor and its antecedent does not involve co-reference. Now, the differences between the two first cases above can be viewed in different terms. My proposal is that the relation between the anaphor and its antecedent is always of the replacing type, even in cases with relational expressions with no explicit anaphor.

Let us concentrate on the Molinés’ instances of replacing anaphora (anaphore substitutive) and relational anaphora (anaphore relationnelle). Consider the following examples:

- (54) O Paulo foi a Londres em 1990. A Maria foi lá no ano seguinte.
‘Paulo went to London in 1990. Maria went there the following year.’
- (55) O Paulo fez o jantar ontem à noite. A Maria tinha cozinhado na véspera.
‘Paulo cooked dinner yesterday evening. Maria had cooked the day before.’
- (56) O Paulo licenciou-se em 1988. A Maria licenciou-se no ano anterior.
‘Paulo graduated in 1988. Maria graduated the previous year.’

If Molinés’ classification presented above were adopted, sequences (54)-(56) above would have to be classified as relational anaphoras. However, and in accordance with the proposal presented in section 2, in all these cases the relational expressions (here, *seguinte*, *véspera* and *anterior*) have a null anaphoric complement. It is this complement that introduces in the semantic representation the anaphoric discourse referent (presented below as \emptyset_{tcc}):

- (57) a. O Paulo foi a Londres em 1990. A Maria foi lá no ano seguinte \emptyset_{tcc} .
 ‘Paulo went to London in 1990. Maria went there the following year.’
- b. O Paulo fez o jantar ontem à noite. A Maria tinha cozinhado na véspera \emptyset_{tcc} .
 ‘Paulo cooked dinner yesterday evening. Maria had cooked the day before.’
- c. O Paulo licenciou-se em 1988. A Maria licenciou-se no ano anterior \emptyset_{tcc} .
 ‘Paulo graduated in 1998. Maria graduated the previous year.’

This means that the relation between the anaphor and its antecedent in (57) is identical to that existing in (58), which according to Molinés would have to be classified as replacing anaphoras.

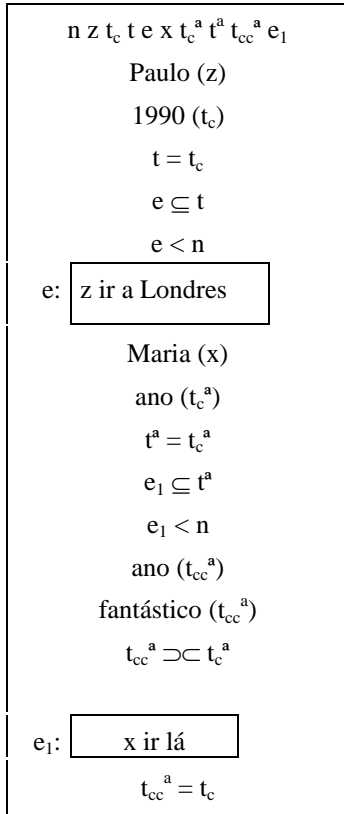
- (58) a. O Paulo foi a Londres em 1990. A Maria foi lá no ano seguinte a esse fantástico ano.
 ‘Paulo went to London in 1990. Maria went there the year after that fantastic year.’
- b. O Paulo fez o jantar ontem à noite. A Maria tinha cozinhado na véspera desse dia.
 ‘Paulo cooked dinner yesterday evening. Maria had cooked the day before that day.’
- c. O Paulo licenciou-se em 1988. A Maria licenciou-se no ano anterior a esse terrível ano.
 ‘Paulo graduated in 1998. Maria graduated the year preceding that terrible year.’

It seems quite clear that the relation between the null anaphor and its antecedent in (57)-(58) is not different from the relation between the lexical anaphora and its antecedent in (59), even if in the former cases the anaphoric expression contains a relational expression whereas in the latter it doesn't.

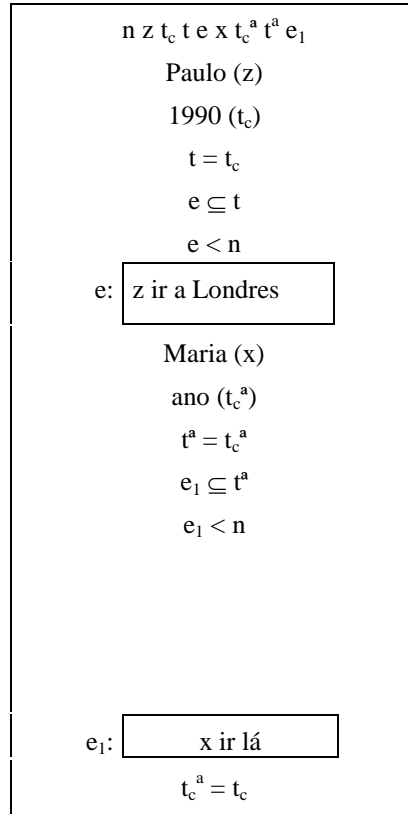
- (59) a. O Paulo foi a Londres em 1990. A Maria foi a Paris nesse ano.
 ‘Paulo went to London in 1990. Maria went to Paris that year.’
- b. O Paulo fez o jantar ontem à noite. A Maria pôs a mesa entretanto.
 ‘Paulo cooked dinner last evening. Meanwhile Maria set the table.’
- c. O Paulo licenciou-se em 1988. Vive em Lisboa desde então.
 ‘Paulo graduated in 1988. He has been living in Lisbon since then.’

In (57), (58) and (59), the relation between the anaphoric expression and its antecedent involves co-reference, which means that in every case we have replacing anaphora. For the sake of illustration, let us compare the simplified representations of (58a) and (59a):

DRS-(58a)



DRS-(59a)



Notice that in both cases the anaphoric referents, t_{cc}^a e t_c^a , respectively, are co-referent with their antecedents, represented here as t_c .

The analysis I am proposing is, thus, different from Molinés' and Bras's proposal, inasmuch as I am not using the concept of relational anaphora. My claim is that the anaphora under study is always of the replacing type, even when relational expressions such as *posteriormente*, *anteriormente*, *antes* or *depois* are involved. The main advantage of this analysis is that it allows a uniform classification of ATLs involving the computation of an anaphor in its complement regardless of their internal structure.

5. ATLs and discourse

In the previous sections of this paper, I have argued that what unifies the locators at stake is the fact that they all represent a time interval whose definition depends on the linguistic context preceding them, and that they all communicate a range of temporal relations between the states of affairs described by the sentences in which the ATLs and their referents occur. However, I do not think that the semantics of such expressions is confined to the expression of temporal relations. Consider the following examples:

- (60) O João assaltou um banco. Foi preso.
'John robbed a bank. He was arrested.'
- (61) O João assaltou um banco. Foi preso depois disso.
'John robbed a bank. Then he was arrested.'
- (62) O João assaltou um banco. Foi preso depois.
'John robbed a bank. Afterwards he was arrested.'

Concerning the temporal relations between the two relevant states of affairs, there is no difference between the three sequences above. However, not all the three sequences have exactly the same interpretation. In the first two, we infer that the second state of affairs is a result of the first. This is not possible in the third case, where the second state of affairs is presented as occurring after the first but not as a result of it. It is important to notice that with respect to the truth conditions they express, there is no difference between *depois* and *depois disso*. To account for this and other similar contrasts, my claim is that these expressions are sensitive to cause-effect (and in other cases, mereological) relations between eventualities. Because of this, ATLs also interact with discourse structure, apparently in two possible ways: (i) blocking a DR that is available in the absence of the ATL (incompatibility cases) or (ii) preserving a DR that is accessible also in the absence of the ATL (compatibility cases). In cases where a DR is blocked, either a new DR becomes available (replacing cases), or the discourse simply becomes incoherent. A formal account of this picture within the SDRT framework is given in section 5.

5.1. Previous research

While the works mentioned in section 2 studied anaphoric temporal locators mainly with respect to their referential dependency, other studies have focused on the interaction between temporal adverbials and discourse structure: Glasbey 1993 and 1994, and, within SDRT, Alves and Txurruka 1999 and 2001, Bras et al. 2001a and 2001b. The works developed within the SDRT framework give accounts of the way some explicit temporal adverbials affect discourse structure and temporal interpretation.

The main focus of Glasbey 1993 and 1994 is on temporal *then*. The author shows that in cases of Elaboration and Background co-temporal *then* does not need an explicit temporal referent, while in other cases an explicit referent is needed. Despite not providing a full account of *same*-temporal adverbials, the author also deals with *at the time* and *at the same time*. She presents several data showing that the locator *at the same time* (in contrast to *at the time*) cannot occur in cases of Background and Elaboration. These locators and others with *same* are studied in Alves and Txurruka 1999 and 2001. The first of these papers introduced the notion of compatibility between a temporal locator and a given discourse relation (DR) to account for the strong effects that temporal locators with *same* may have on discourse structure. The second one, a revised and substantially developed version of the first, showed that those locators interact with discourse relations, always blocking those DRs involving a mereological relation between two states of affairs (Elaboration, Background and Generalisation) and sometimes blocking discourse relations associated with a causal link (Result and Explanation). To account for these effects they propose that what is signalled by *same* is an “unexpected temporal identity”. This explains why *same*-locators are not compatible with DRs according to which that identity is expected or, in other words, are incompatible with cases where the identity condition expressed by *same* is implied in the discourse environment.

Bras *et al.* 2001a and 2001b concentrate on the role played by the French expressions *puis* and *un peu plus tard*, concluding that the former is a marker of Strong-Narration (temporal succession and “same story”) whereas the latter blocks this DR, licensing only Weak Narration (temporal succession). Another difference between the two adverbials is that *puis* blocks Result, whereas *un peu plus tard* does not.

5.2. Inferring temporal information from discourse structure

Let us start by considering discourse sequences (periods of two juxtaposed sentences) without any explicit ATL temporally relating the two relevant states of affairs, like those below:

- (63) A Maria lavou os dentes. Foi para a cama.
‘Maria brushed her teeth. She went to bed.’
- (64) O Paulo foi preso. Assaltou um banco.
‘Paulo was arrested. He robbed a bank.’
- (65) A Maria teve um acidente de carro há dois anos. Deixou de guiar.
‘Maria had a car accident two years ago. She quit driving.’
- (66) A Maria foi a Paris. Ficou hospedada no Hilton.
‘Maria went to Paris. She stayed at the Hilton.’

(67) A Maria foi a Londres. Visitou o Big Ben.
 ‘Maria went to London. She visited the Big Ben.’

(68) A Maria visitou Londres em 1980. Tinha quinze anos.
 ‘Maria visited London in 1980. She was 15 years old.’

Examples of this type illustrate our ability to assign a correct temporal interpretation to different kinds of discourse sequence in the absence of any explicit adverbial clue. According to several authors (e.g., Hinrichs 1981 and 1986, Kamp and Reyle 1993, Lascarides and Asher 1993), tense and *aktionsart* are not sufficient to account for the right interpretation of sequences such as (64) and (67). Examples like these were presented in the literature (e.g., Lascarides and Asher 1993) to show that it is tense and aspect together with world knowledge, in particular knowledge about how situations interact with each other, that helps understanding how the two sentences are rhetorically connected and to infer how the two states of affairs are temporally related. Concerning the examples above, this knowledge tells us that: in (63), the second segment describes a state of affairs that typically occurs after the state of affairs described in the first; in (64), the second segment presents an explanation of the state of affairs described in the first; in (65), the second segment describes a result of the state of affairs described in the first; in (66) and (67) the state of affairs described in the second segment is part of the state of affairs described in the first. In (68), the second state of affairs backgrounds the state of affairs previously described. In terms of discourse relations, (63) is an instance of Narration, (64) an instance of Explanation, (65) a instance of Result, (66) and (67) instances of Elaboration, and (68) is a case of Background. This leads us to conclude that: in (64), the state of affairs described in the second segment temporally precedes the state of affairs described in the first; in (63) and (65), the state of affairs described in the second segment temporally follows the state of affairs described in the first; in (66) and (67), a relation of temporal inclusion obtains between the state of affairs described in the second segment and the state of affairs described in the first; finally, in (68), the second state of affairs temporally includes the first.

Conversational maxims such as the Gricean “Be orderly”, a sub-maxim of the category Manner (cf. Grice 1975: 46) which requires that the speakers present their material orderly, also plays an important role in the temporal interpretation of discourse sequences (cf. Lascarides and Asher 1993, Bras et al. 2001a and 2001b) Notice that, although it is common knowledge that people usually brush their teeth before going to bed, this interpretation is not easily available in (69), where the textual order tells the opposite:

(69) A Maria foi para a cama. Lavou os dentes.
 ‘Maria went to bed. She brushed her teeth.’

In examples like those given in (63)-(67), it is, along the lines of theories such as SDRT, discourse structure that helps the hearer to recover temporal information that somehow is implicit (watch the information between brackets):

- (70) A Maria lavou os dentes (num tempo t). Foi para a cama (num tempo t_1 , tal que $t < t_1$).
'Maria brushed her teeth (at a time t). She went to bed (at a time t_1 such that $t < t_1$).'
- (71) O Paulo foi preso (num tempo t). Assaltou um banco (num tempo t_1 , tal que $t_1 < t$).
'Paulo was arrested (at a time t). He robbed a bank (at a time t_1 such that $t_1 < t$).'
- (72) A Maria teve um acidente (num tempo t) de carro há dois anos. Deixou de guiar (num tempo t_1 , tal que $t < t_1$).
'Maria had a car accident two years ago (at a time t). She quit driving (at a time t_1 such that $t < t_1$).'
- (73) A Maria foi a Paris (num tempo t). Ficou hospedada no Hilton (num tempo t_1 , tal que $t_1 \subseteq t$).
'Maria went to Paris (at a time t). She stayed at the Hilton (at a time t_1 such that $t_1 \subseteq t$).'
- (74) A Maria foi a Londres (num tempo t). Visitou o Big Ben (num tempo t_1 , tal que $t_1 \subseteq t$).
'Maria went to London (at a time t). She visited Big Ben (at a time t_1 such that $t_1 \subseteq t$).'
- (75) A Maria foi a Londres (num tempo t). Tinha quinze anos (num tempo t_1 , tal que $t \subseteq t_1$).
'Maria went to London (at a time t). She was fifteen years old (at a time t_1 such that $t \subseteq t_1$).'

5.3. Building discourse structure from temporal relations

Let us observe now sequences with explicit ATLs. To be more precise, let us monitor the effect of introducing explicit ATLs in sequences like those presented before. As will be shown below, after the introduction, in sequences such as (63)-(67), of an explicit ATL expressing the temporal ordering that was inferred in its absence, only in some cases are the above mentioned interpretations allowed. In the other cases, the existing interpretations and associated DRs are no longer possible. This means that not only does discourse structure have impact on temporal interpretation but also that temporal expressions have effects on discourse structure. Three subclasses of

locators will be focused: (i) locators that express forward sequencing – e.g., *depois* (after), *depois disso* (after that), *a seguir* (afterwards); (ii) locators that express backward sequencing – e.g., *antes* (before), *antes disso* (before that); and (iii) locators expressing temporal overlap – e.g., *enquanto isso* (meanwhile), *entretanto* (in the meantime) or *durante esse tempo* (during that time). These locators are inserted in sentence final position in sequences of two juxtaposed sentences with the *pretérito perfeito simples* (simple past).

5.3.1 Forward sequencing ATLs

When an explicit ATL is added to narrative sequences, the discourse structure previously inferred is reinforced:

- (76) A Maria lavou os dentes. Foi para a cama
‘Maria brushed her teeth. She went to bed.’
- (77) a. A Maria lavou os dentes. Foi para a cama depois.
‘Maria brushed her teeth. She went to bed afterwards.’
b. A Maria lavou os dentes. Foi para a cama depois disso.
‘Maria brushed her teeth. She went to bed after that.’
c. A Maria lavou os dentes. Foi para a cama a seguir
‘Maria brushed her teeth. Next she went to bed.’
d. A Maria lavou os dentes. Foi para a cama a seguir a isso.
‘Maria brushed her teeth. Then she went to bed.’
e. A Maria lavou os dentes. Foi para a cama meia-hora depois.
‘Maria brushed her teeth. She went to bed half an hour later.’

Let us consider now sequences involving a causal link between the two states of affairs (Result cases), as (78):

- (78) A Maria teve um acidente de carro há dois anos. Deixou de guiar.
Maria had a car accident two years ago. She quit driving.

In (78), the second segment is most naturally interpreted as a result of the state of affairs described in the first. This inference is preserved in the sequences in (79) where the locators *depois disso* and *a seguir a isso* and *dois dias depois*, respectively, have been inserted.

- (79) a. A Maria teve um acidente de carro há dois anos. Deixou de guiar depois disso.
‘Maria had a car accident two years ago. She quit driving after that.’
b. A Maria teve um acidente de carro há dois anos. Deixou de guiar a seguir a isso.
‘Maria had a car accident two years ago. Then she quit driving.’

- c. A Maria teve um acidente de carro há dois anos. Deixou de guiar dois dias depois.
'Maria had a car accident two years ago. She quit driving two days after.'

If, however, these ATLs are replaced by *depois* and *a seguir*, the inference is blocked:

- (80) a. A Maria teve um acidente de carro há dois anos. Deixou de guiar depois.
'Maria had a car accident two years ago. She quit driving afterwards.'
b. A Maria teve um acidente de carro há dois anos. Deixou de guiar a seguir.
'Maria had a car accident two years ago. Next she quit driving.'

While in (78) and (79) the second segment is easily interpreted as describing a result of the car accident described in the first, in (80) what the discourse sequence conveys is just forward sequencing, without the speaker committing herself to a consequence relation between the two states of affairs.

5.3.2. Backward sequencing ATLs

I shall start with the cases where the second segment describes a state of affairs that is part of the first, i.e., Elaboration sequences. For instance:

- (81) A Maria foi para a cama. Lavou os dentes.
'Maria went to bed. She brushed her teeth.'

The presence of an ATL, as in (82), causes no change with respect to what is communicated by the sequence without the ATL:

- (82) a. A Maria foi para a cama. Lavou os dentes antes.
'Maria went to bed. She brushed her teeth beforehand.'
b. A Maria foi para a cama. Lavou os dentes antes disso.
'Maria went to bed. She brushed her teeth before that.'
c. A Maria foi para a cama. Lavou os dentes dez minutos antes.
'Maria went to bed. She brushed her teeth ten minutes before'.

Another example:

- (83) A Maria viajou para o Brasil. Comprou o bilhete na TAP.
'Maria travelled to Brazil. She bought her ticket at TAP.'

If the ATLS *antes* or *duas semanas antes* are added, no change takes place, concerning the sequence interpretation:

- (84) a. A Maria viajou para o Brasil. Comprou o bilhete na TAP antes.
 ‘Maria travelled to Brazil. She bought her ticket at TAP beforehand.’
 b. A Maria viajou para o Brasil. Comprou o bilhete na TAP duas semanas antes.
 ‘Maria travelled to Brazil. She bought her ticket at TAP two weeks before.’

Notice, however, that, if *antes disso* is added or if *antes* is moved to sentence-initial position, the Elaboration reading is blocked (due to space constraints, I will not elaborate here on the contrast between *antes* in sentence-initial position and in sentence-final position).

- (85) a. A Maria viajou para o Brasil. Comprou o bilhete na TAP antes disso.
 ‘Maria travelled to Brazil. She bought her ticket at TAP before that.’
 b. A Maria viajou para o Brasil. Antes comprou o bilhete na TAP.
 ‘Maria travelled to Brazil. Beforehand she bought her ticket at TAP.’

What is understood is that Maria bought a plane ticket (but not the one she needed to go to Brazil) before travelling to Brazil.

Next, I shall focus on the cases where the second segment provides an explanation for the state of affairs described in the first (Explanation), as follows:

- (86) O Paulo foi preso. Assaltou um banco.
 ‘Paulo was arrested. He robbed a bank.’
- (87) a. O Paulo foi preso. Assaltou um banco antes.
 ‘Paulo was arrested. He robbed a bank beforehand.’
 b. O Paulo foi preso. Assaltou um banco antes disso.
 ‘Paulo was arrested. He robbed a bank before that.’
 c. O Paulo foi preso. Assaltou um banco duas semanas antes.
 ‘Paulo was arrested. He robbed a bank two weeks before.’

In (87), where explicit ATLS were introduced, the interpretation that the second segment gives an explanation for the state of affairs previously presented is no longer available. Once more, we understand the discourse as

conveying only temporal backwards sequencing. Neither *antes* nor *antes disso* and *duas semanas antes* are compatible with Explanation.

5.3.3. Overlapping ATLs

Thirdly, let us turn to cases involving ATLs that express temporal overlapping. Sequence (88) is understood as communicating that the state of affairs described in the second segment is a part of the state of affairs described in the first.

- (88) A Maria foi a Paris. Ficou hospedada no Hilton.
'Maria went to Paris. She stayed at the Hilton.'

In (89), to which *durante esse tempo* was added, the sequence is still understood as (88):

- (89) A Maria foi a Paris. Ficou hospedada no Hilton durante esse tempo.
'Maria went to Paris. She stayed at the Hilton during that time.'

However, this interpretation is blocked in (90), where *entretanto* and *enquanto isso* are present.

- (90) A Maria foi a Paris. Ficou hospedada no Hilton {entretanto / enquanto isso}.
'Maria went to Paris. {In the meantime / meanwhile} she stayed at the Hilton.'

What happens here is that a mereological relation between the two relevant states of affairs is blocked. The sequence is understood as communicating temporal parallelism. It can be appropriately used in a situation in which it is known that Maria is staying at the Hilton in Lisbon and that she keeps her room there while she goes to Paris for a few days. In contrast with *durante esse tempo*, *entretanto* and *enquanto isso* are, thus, incompatible with Elaboration. Similarly, in (91), the presence of *então* preserves the background reading, whereas *entretanto* does not.

- (91) a. A Maria licenciou-se em Junho de 1988. O Pedro estava em Paris.
'Maria graduated in June 1988. Pedro was in Paris.'
b. A Maria licenciou-se em Junho de 1988. O Pedro estava então em Paris.
'Maria graduated in June 1988. Pedro was in Paris then.'
c. A Maria licenciou-se em Junho de 1988. O Pedro estava em Paris entretanto.
'Maria graduated in June 1988. In the meantime Pedro was in Paris.'

(91a) communicates that Pedro was in Paris at the time when Maria graduated, that is, concluded her studies. The reading we get in (91c), however, is that Pedro was in Paris during the years when Maria did her studies.

The relevant data having been presented, what can be concluded is the following: depending on the ATL, (i) Elaboration cases and Results are preserved or blocked, (ii) Explanations are always blocked when an explicit ATL is inserted, and (iii) Narration cases are always preserved when a forward sequencing ATL is added. With respect to the Explanation cases it is important to mention that the results presented here are in accordance with the description found in Tenbrink 2003 and in Tenbrink and Schilder 2003 for *before* and *after*. According to these authors, the presence of *before* implies that no causal link exists between the two relevant states-of-affairs. It contrasts with *after*, which is compatible with the existence of a cause-effect link.

It is also worth adding that other ATLs conveying backward sequencing but not involving *antes* (*before*) do not seem to block a cause-effect link. Alves 2003 gives examples involving *na semana anterior* (*the previous week*) in sequences where the second clause is in the ‘pretérito mais-que-perfeito’ – pluperfect – (cf. p. 300):

(92) O Paulo foi despedido no dia 15 de Junho. Tinha desviado dinheiro da empresa na semana anterior.

‘Paulo was fired on June 15th. He had stolen money from the company where he worked the previous week.’

So, it seems plausible that the blocking of causal links with explicit ATLs is related to *before* locators in particular, lacking the status of a general constraint.

One might argue at this point that *depois disso* has a different meaning than *depois*, namely that *depois disso* is temporal-consequential and that *depois* is just temporal. At least two arguments can be used against this hypothesis. One is that it is not always the case that *depois disso* has a temporo-consequential meaning (cf. (93), which means that one would have to assume the existence of two *depois disso*).

(93) A Maria foi ao supermercado. Foi ao banco {depois / depois disso}.

The Maria went to_the supermarket. Ø_{she} went to_the bank {afterwards/ after that}’

Maria went to supermarket. She went to the bank {afterwards/ after that}.

Furthermore, the consequence relations were already in force before *depois disso* was inserted, which must be taken as an argument against the hypothesis that they are introduced by the ATL (cf. (94) and (95)).

- (94) a. A Maria roubou dinheiro à companhia para a qual trabalhava. Foi despedida.
'Maria stole money from the company where she worked. She was fired.'
- b. A Maria roubou dinheiro à companhia para a qual trabalhava. Foi despedida depois disso.
'Maria stole money from the company where she worked. She was fired after that.'
- (95) a. O Paulo ganhou a lotaria. Deixou de trabalhar.
'Paulo won the lottery. He stopped working.'
- b. O Paulo ganhou a lotaria. Deixou de trabalhar depois disso.
'Paulo won the lottery. He stopped working after that.'

Similarly, one might argue that *entretanto* and *enquanto isso* differ in meaning from *durante esse tempo*, for the latter, unlike the former two, occurs in sequences where a mereological relation exists between two states of affairs. Once again, this is disputable, inasmuch as the mereological relation is not introduced by *durante esse tempo*, but is instead inferred in the absence of the ATL.

- (96) a. A Maria foi a Paris. Comeu *croissants* ao pequeno almoço todos os dias.
'Maria went to Paris. She had *croissants* for breakfast every day.'
- b. A Maria foi a Paris. Comeu *croissants* ao pequeno almoço todos os dias durante esse tempo.
'Maria went to Paris. During that time she had *croissants* for breakfast every day.'

Furthermore, the three locators are interchangeable in other contexts:

- (97) A Maria foi nadar. {Durante esse tempo / entretanto / enquanto isso} roubaram-lhe o carro.
'Maria went to for a swim. {During that time / in the meantime / meanwhile} her car was robbed.'

In brief, my claim is the following: cause-effect or mereological relations between states of affairs are not part of the ATLs semantic meaning, given the fact they are inferable when an ATL is not present. However, ATLs are, apparently, sensitive to these relations. This has consequences for discourse

structure insofar as, along the lines of theories such as SDRT, relations between situations are important in the inference of discourse relations. This would explain the (in)compatibility cases that were mentioned above. Accordingly, restrictions such as those illustrated above should be accounted for pragmatically.

6. A proposal within SDRT

Segmented Discourse Representation Theory, a non-trivial extension of DRT, aims to account for the fact that discourse structure affects discourse content. Consequently, in SDRT the operation of processing a new sentence is much more complex than in DRT (as sketched in Kamp and Reyle 1993). In DRT, this operation consists in the union of discourse referents and discourse conditions. In SDRT this operation is more sophisticated, consisting of a two-step procedure: (i) the identification of the open attachment sites to which the new segment can be attached, and (ii) choosing a Discourse Relation by means of which the attachment is made. In SDRT, Discourse Relations are presented as the glue that links discourse segments. Along the same lines of Hobbs 1979 and 1985, Mann and Thompson 1987, SDRT proposes a set of Discourse Relations, which includes the following: Contrast, Parallelism, Narration, Explanation, Result, Background and Elaboration. To account for the various types of knowledge involved in steps 1 and 2, SDRT uses a non-monotonic logic called Commonsense Entailment (CE). This logic uses two different conditional operators: the former is associated with a defeasible implication while the latter is associated with a non-defeasible one. In the inferential process of Discourse Relations, several reasoning patterns play a crucial role. Among them are the following: Defeasible Modus Ponens, Penguin Principle (in case of conflict between two rules, choose the one with the most specific antecedent), Nixon Diamond (if there are two rules with independent conflicting antecedents, neither applies).

Here, we are particularly interested in those discourse relations that have a temporal component, that is, Narration, Explanation, Result, Elaboration and Background, illustrated once again in (98)-(102), respectively:

- (98) Maria brushed her teeth. She went to bed.
- (99) Paulo was arrested. He robbed a bank.
- (100) Maria had a car accident two years ago. She stopped driving.
- (101) Maria travelled to Brazil. She bought her ticket at TAP.
- (102) Maria arrived home at midnight. Paulo was sleeping.

They are formally presented in Lascarides and Asher 1993 in the following way:

- (103) $\Box (\text{Narration}(\alpha, \beta) \rightarrow \text{me}(\alpha) < \text{me}(\beta))$
 Temporal axiom: $\Box (\text{Narration}(\alpha, \beta) \rightarrow \text{me}(\alpha) < \text{me}(\beta))$
- (104) $\langle \alpha, \beta \rangle \wedge \text{causes}(\text{me}(\beta), \text{me}(\alpha)) > \text{Explanation}(\alpha, \beta)$
 Temporal axiom: $\Box (\text{Explanation}(\alpha, \beta) \rightarrow \neg [\text{me}(\alpha) < \text{me}(\beta)])$
- (105) $\langle \alpha, \beta \rangle \wedge \text{causes}(\text{me}(\alpha), \text{me}(\beta)) > \text{Result}(\alpha, \beta)$
 Temporal axiom: $\Box (\text{Result}(\alpha, \beta) \rightarrow \text{me}(\alpha) < \text{me}(\beta))$
- (106) $\langle \alpha, \beta \rangle \wedge \text{prep}(\text{me}(\beta), \text{me}(\alpha)) > \text{Elaboration}(\alpha, \beta)$
 Temporal axiom: $\Box (\text{Elaboration}(\alpha, \beta) \rightarrow \neg [\text{me}(\alpha) < \text{me}(\beta)])$
- (107) $\langle \alpha, \beta \rangle \wedge \text{state}(\text{me}(\beta)) > \text{overlap}(\text{me}(\alpha), \text{me}(\beta))$
 $\langle \alpha, \beta \rangle \wedge \text{overlap}(\text{me}(\alpha), \text{me}(\beta)) > \text{Background}(\alpha, \beta)$
 Temporal axiom: $\Box (\text{Background}(\alpha, \beta) \rightarrow \text{overlap}(\text{me}(\alpha), \text{me}(\beta)))$

Concerning Narration, the definition of this DR was refined in later works. First, a rule according to which Narration is only inferred in the absence of clues indicating another DR was added (cf. Bras et al. 2001a: 51).

- (108) $\langle \tau, \alpha, \beta \rangle \wedge \neg \text{Clues_R}_1(\tau, \alpha, \beta) \wedge \neg \text{Clues_R}_2(\tau, \alpha, \beta) \wedge \dots \wedge \neg \text{Clues_R}_n(\tau, \alpha, \beta) > \text{Narration}(\alpha, \beta)$

Second, a new rule accounting for the inference of Narration from Occasion was introduced (cf. Bras et al. 2001a: 51):

- (109) $\langle \tau, \alpha, \beta \rangle \wedge \text{Occasion}(\alpha, \beta) > \text{Narration}(\alpha, \beta)$

Based on Schank's notion of *script* (cf. Schank and Abelson 1977), Occasion holds when the second event is a typical sequence of the first (e.g., knock on the door – enter the room). In addition, a new and stronger temporal axiom is introduced. According to this rule, there is overlap between the poststate of e_α and the prestate of e_β :

- (110) $\text{Narration}(\alpha, \beta) \rightarrow e_\alpha \supset \supset (\text{post}(e_\alpha) \cap \text{pre}(e_\beta)) \supset \supset e_\beta$
 (cf. Bras et al. 2001a: 51)

The preserving cases involving Narration, Background, Elaboration and Result can be accounted for by rules as the following:

- (111) $\langle\langle\tau, \alpha, \beta\rangle \wedge [\{\text{depois / a seguir}\}]\rangle (\beta) > \text{Narration}(\alpha, \beta)$.
- (112) $\langle\langle\tau, \alpha, \beta\rangle \wedge \text{part-of}(\text{me}(\beta), \text{me}(\alpha)) \wedge \text{durante esse tempo}(\beta)\rangle > \text{Elaboration}(\alpha, \beta)$.
- (113) $\langle\langle\alpha, \beta\rangle \wedge \text{overlap}(\text{me}(\alpha), \text{me}(\beta)) \wedge [\{\text{então / na altura}\}]\rangle (\beta) > \text{Background}(\alpha, \beta)$
- (114) $\langle\langle\alpha, \beta\rangle \wedge \text{causes}(\text{me}(\alpha), \text{me}(\beta)) \wedge \text{depois disso}(\beta)\rangle > \text{Result}(\alpha, \beta)$.

The blocking cases presented above can be accounted for by the following axioms:

- (115) $\langle\langle\tau, \alpha, \beta\rangle \wedge [\{\text{depois / a seguir}\}]\rangle (\beta) \rightarrow \neg \text{Result}(\alpha, \beta)$.
- (116) $\langle\langle\tau, \alpha, \beta\rangle \wedge [\{\text{antes / antes disso / x-tempo antes}\}]\rangle (\beta) \rightarrow \neg \text{Explanation}(\alpha, \beta)$.
- (117) $\langle\langle\tau, \alpha, \beta\rangle \wedge [\{\text{entretanto / enquanto isso}\}]\rangle (\beta) \rightarrow \neg \text{Elaboration}(\alpha, \beta)$.
- (118) $\langle\langle\tau, \alpha, \beta\rangle \wedge [\{\text{entretanto / enquanto isso}\}]\rangle (\beta) \rightarrow \neg \text{Background}(\alpha, \beta)$.

However, these axioms do not account for the fact that in some cases *antes disso* blocks Elaborations (cf. (85)) and in some other cases it does not (cf. (82)). It remains an open question requiring further research.

7. Conclusion

I have given a formal account of the meaning of anaphoric temporal locators in Portuguese. In general terms, my central claim is that the basic meaning of ATLS consists of a temporal relation. Seeking a deeper insight into this class, I observed that ATLS can express a single temporal relation and still interact in different ways with the DRs. My explanation for this diversity is that ATLS are sensitive to cause-effect and mereological relations holding between situations, and as a result they can be compatible or incompatible with discourse relations. These constraints have been analysed not as part of the ATLS' meaning, but rather as part of their pragmatics. They were accounted for within the SDRT framework.

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