Anaphoric Temporal Locators and Discourse Structure

Several authors (cf., e.g., Asher 1993) have used discourse structure to constrain anaphora resolution, that is, to prevent cases where the anaphor is not identified with the right antecedent. Others – cf. Alves and Txurruka 1991 and 2001, Bras *et al*. 2001a and 2001b, and Alves 2003 – have studied the interaction between temporal adverbials and discourse structure, showing that not only does discourse structure have impact on temporal relations (cf. e.g. Lascarides and Asher 1983 and Kamp and Reyle 1983) but also that temporal explicit connectives might have impact on discourse structure. This paper is about adverbial temporal locators and discourse structure. In particular, I shall focus on ambiguity involving a group of anaphoric temporal locators that I'll call anaphoric temporal locators without predicative content. These locators underspecify their antecedents. Because of this, they can relate both to antecedents provided by time-denoting expressions and to antecedents representing the running time of an eventuality, giving rise to ambiguity cases in sequences where both kinds of antecedents are available. In most cases, however, ambiguity does not arise due, that's my claim, to constraints related to world-knowledge and discourse structure, which leads to disambiguation. A proposal to account for anaphora involving these locators is made within *Segmented Discourse Representation Theory* (cf., e.g., Asher 1993). I'll concentrate on anaphoric temporal locators both in English and in Portuguese, although here, due to space constraints, only examples in English are presented.

Anaphoric temporal locators are expressions as those in bold type in the following examples:

(1)   John was born in 1980. Mary was born **the same year**.
(2)   John gave a party last weekend. He met Mary **then**.
(3)   Mary arrived in Lisbon on May 12th. John arrived **the previous day**.

These expressions temporally locate the eventuality described by the sentence in which they occur, and they are anaphoric because the definition of the time interval they represent depends on the linguistic context that precedes them.

(4)   ????Mary was born **the same year**.
(5)   ????He met Mary **then**.
(6)   ????John arrived **the previous day**.

In DRT terms (cf. e.g., Kamp and Reyle 1993), they introduce in the respective DRS the following elements: (i) a new discourse referent *t*; (ii) an identity condition of the type [t=?]; (iii) depending on the type of locator, predicative conditions such as [year(t)] or [day(t)]; (iv) other conditions, depending on the existence of relational expressions as, for instance, *same* and *following*. Antecedents of anaphoric temporal locators are discourse referents of type *t* already present in the DRS under construction. They are introduced in the DRS directly by time-denoting expressions – cf. the expressions underlined in (7)-(9) – or indirectly via several types of functions that account for the possibility of our inferring time from eventuality descriptions, as in (10)-(13).

(7)   John visited Paris in <u>1980</u>. Mary visited London that year.
(8)   John had a car accident <u>last Monday</u>. He arrived late to school that day.
(9)   Mary graduated in <u>June 1987</u>. John graduated the same month.

(10)   Mary went to Paris. She stayed at the Hilton then.
(11)   Last evening John cooked dinner. Meanwhile Mary read the newspaper.
(12)   Mary wrote John a letter. He answered her the same week.
(13)   John had a car accident last week. He arrived late to school that day.

In (10)-(11), function **loc** which assigns to an eventuality the interval of time it occupies (cf Kamp and Reyle 1993: 608) introduces in the DRS the necessary anaphoric antecedents of *then* and *meanwhile*. In (12) and (13), functions s-loc and d-loc (cf. Alves 2003) respectively assign to an eventuality the day and the week in which it occurred.

In what concerns the question under study here, a relevant distinction is that between locators with predicative content as *that month, the same year, the day before* and locators without predicative content as, for instance, *then, after that, at the time*. The former introduce DRS conditions as those mentioned in (iii), whereas the latter do not. The former constrain the expression providing their antecedents to describe a certain calendar unit (day, month, year, etc.), whereas the latter somehow underspecify their antecedents. This means that (at least some) locators without predicative content might pick up discourse referents introduced by time-denoting expressions and discourse referents introduced via the above mentioned functions. See the following examples:

(14)   Mary arrived home around midnight. John arrived after that.
(15)   John visited Paris in 1980. Mary visited London then.

These examples are ambiguous in what concerns the anaphoric antecedent of the temporal locators. In (14), *after that* might refer back to the discourse referent introduced by *around midnight* or to the discourse referent supplied by the eventuality of Mary's arriving home. In (15) *then* might 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 (15) communicates is that Mary visited London while John visited Paris or else that Mary visited London in the same year that John visited Paris. For the sake of illustration, see below the DRSs corresponding to the two possible interpretations of (15), where the conditions regarding the anaphor and the anaphoric antecedent are in bold type:

DRS-(15)a

$$n\ x\ y\ t_c\ t\ e\ t'\ w\ z\ t^a\ t_c^a\ e_1$$

John (x)
Paris (y)
1980 (t_c)
$t = t_c$
$e \subseteq t$
$e < n$

e: | x visit y |
$loc(e) = t'$
Mary (w)
London (z)
$t^a = t_c^a$
$e_1 \subseteq t^a$
$e_1 < n$

e_1 | w visit z |
$t_c^a = t_c$

DRS-(15)b

$$n\ x\ y\ t_c\ t\ e\ t'\ w\ z\ t^a\ t_c^a\ e_1$$

John (x)
Paris (y)
1980 (t_c)
$t = t_c$
$e \subseteq t$
$e < n$

e: | x visit y |
$loc(e) = t'$
Mary (w)
London (z)
$t^a = t_c^a$
$e_1 \subseteq t^a$
$e_1 < n$

e_1 | w visit z |
$t_c^a = t'$

However, even though locators without predicative content might pick up different types of antecedents, in most cases ambiguity does not arise. Consider the following examples, involving the discourse relations of Elaboration, Background and Result (cf. Lascarides and Asher 1993, for a definition of these DRs):

(16)   John visited Paris in 1980. He saw the Mona Lisa then.
(17)   John visited Paris in 1980. He was 20 years old at the time.
(18)   Ana had a car accident in 1980. She quit driving after that.

In these sequences, the anaphoric locators – *then, at the time* and *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 (16), Background in (17), and Result in (18). 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.

Let us consider now examples involving other types of discourse relations, namely Contrast (signalled here by *but*) and Parallel (marked by *also*):

(19)   Mary arrived home around midnight, but John arrived after that.
(20)   John visited Paris in 1980, but Mary visited London then.

(21) John visited Paris in 1980. Mary also visited Paris then
(22) John visited Paris in 1980. He also saw the Mona Lisa then.

In the Contrast cases (cf. (19)-(20)), the only possible interpretations seem to be those where the anaphoric locators refer back to *around midnight* and *1980*, respectively. It is the presence of *but* and its explicit marking of Contrast (to be distinguished from Expectation Denial) that blocks the reading according to which the anaphors relate to the running times of the previously described eventualities. Notice that these same examples, without *but*, were shown above to be ambiguous (cf. (14)-(15)). Similarly, in the Parallel cases (cf. (21)-(22)), the only available readings seem to be those in which the occurrences of *then* refer to *1980*. (22), in particular, sounds odd. There seems to be a conflict between our world knowledge, which tells us that seeing the Mona Lisa in the Louvre is part of typical visit to Paris, and the presence of *also*, indicating that the second eventuality cannot be interpreted as being part of the first. The explicit marker *also* blocks the Elaboration reading and the resulting discourse is hard to interpret, unless we introduce new linguistic material in the context as (23) a-b below:

(23) a. John visited Paris in 1979.
      b. He saw the Mona Lisa.
      c. He visited Paris in 1980.
      d. He also saw the Mona Lisa then.

However, here, what licenses *also* is not sentence c. but sentence b. Regarding Parallel and Contrast, what seems to be the case is that these discourse relations appear to be incompatible with temporal inclusion of eventualities, this being the reason why one of the two available antecedents is excluded.

The examples given below are different than those presented before. Here the anaphor refers back to a time interval whose boundaries are provided by the linguistic context (and in the second case also by utterance time), although that interval is not directly represented in the same linguistic context.

(24) Mary left Paris in May and returned in June. In the meantime, her car was robbed.

(25) The school will hire a new teacher only next year. In the meantime, Mary teaches course 303.

The linguistic context provides with more than one possible antecedent, but also here world-knowledge and discourse structure constrain the antecedents to be, in the first case, the running times of the described eventualities (and not *May* and *June*) and in the second case the running time associated to the hiring of a new teacher (and not *next year*). If we understand that in (24) the second eventuality is somehow enabled by the first (Enablement) and that in (25) the second eventuality is a result of the first (Result), then the anaphors have to be resolved as said above.

Conclusions

As was shown above, some anaphoric temporal locators might relate to more than one antecedent giving rise to ambiguity cases that discourse structure. Discourse structure helps to disambiguate those cases. The choice of an antecedent is related to the discourse relation that holds between the discourse segment where the anaphor occurs and the segment providing possible antecedents. This is true not only about discourse relations that have been described in the literature as having temporal impact (Background, Elaboration, and Result), but also about others as Parallel and Contrast. To account for such locators and for the anaphoric relation they express, a framework involving the computation of discourse structure, as for instance SDRT, is therefore needed.

References

ALVES, Ana Teresa and Isabel Gómez Txurruka: 1999, "Blocking Discourse Relations: *same* in Anaphoric Temporal Adverbials" In *Actes de l'Atelier Thématique Théories Sémantiques et Pragmatiques : le Temps, L'éspace et le Mouvement, du Léxique, au Discours et au Dialogue*, (Laure Vieu et Myriam Bras, orgs.), 6ème Conférence Annuelle sur le Traitement Automatique des Langues Naturelles, 12-17 July 1999, Corse, 5-16.

ALVES, Ana Teresa and Isabel Gómez Txurruka: 2001, "The Meaning of *same* in Anaphoric Temporal Adverbials". In *Semantic and Pragmatic Issues in Discourse and Dialogue*: *Experimenting with Current Dynamic Theories*, (M. Bras & L. Vieu, editors), Elsevier, Oxford, 147-181.

ALVES, Ana Teresa: 2003, *Sobre a Localização Temporal Adverbial Anafórica em Português*. PhD. diss., Universidade dos Açores, Ponta Delgada.

ASHER, Nicholas: 1993, *Reference to Abstract Objects in Discourse*, Kluwer Academic Publishers, Dordrecht.

BRAS, Myriam, Anne Le Draoulec and Laure Vieu : 2001a, "French Adverbial *Puis*: between Temporal Structure and Discourse Structure". In *Semantic and Pragmatic Issues in Discourse and Dialogue*: *Experimenting with Current Dynamic Theories*, (M. Bras & L. Vieu, editors), Elsevier, Oxford, 109-145.

BRAS, Myriam, Anne Le Draoulec and Laure Vieu : 2001b, "Temporal Information and Discourse Relations in Narratives: the Role of French Adverbial *puis* and *un peu plus tard*", In *Workshop Proceedings: Temporal and Spatial Information Processing,* 39th Annual Meeting and 10th Conference of the European Chapter of Association for Computational Linguistics, 2001, Toulouse, 49-56.

KAMP, Hans and Uwe Reyle: 1993, *From Discourse to Logic. Introduction to Modeltheoretic Semantics of Natural Language, Formal Logic and Discourse Representation Theory*, Kluwer, Dordrecht.

LASCARIDES, Alex and Nicholas Asher: 1993, "Temporal Interpretation, Discourse Relations and Common Sense Entailment", *Linguistics and Philosophy* **16,** 437-493.