DRT's treatment of inference and presupposition as a source of semantic enrichment

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1   Inferential semantic enrichment in discourse interpretation

The Discourse Representation Theory (DRT) (Kamp & Reyle 1993) provides an explanation of the semantic enrichment processes that are present in discourse, by means of the structure of the successive representations associated to a concrete sequence of utterances. In the case of pronominal anaphora or indefinites, interpretation is just possible in relation with those elements present in discourse or in associated databases. Each Discourse Representation Structure (DRS) can be seen as a database within which certain information about the world is codified. So, when the speaker codifies a message, we can think on a selection of lexical elements suitable for representing the referred individuals and the properties they have, the relations they hold in a concrete description of the world and even the properties and relations between this description of the world and other ones. All these elements are combined using certain rules; so the hearer obtains from the speaker a series of linguistic data to which he must apply his grammatical, logical and encyclopaedic knowledge in order to be able of decodifying the complete information. In a very general way, the following scheme could be an illustration of discourse interpretation process:
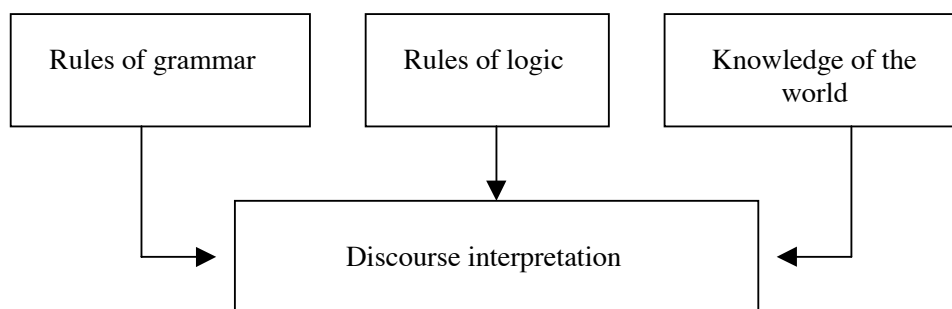

Figure 1

Grammar, logic and encyclopaedic knowledge appear in this scheme as separate modules with a unique and final relation: the interpretation of the speaker utterances. Nevertheless, there are enough reasons to think that the established relations among these modules are closer. Without discussing questions about syntactic or morphological iconicity and those logical aspects that are more evident in natural language grammar, we can consider

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that the interpretation of any linguistic utterance rests on the application of all these knowledge modules to the intermediate representations of discourse that are necessary for evaluating the speaker utterances. Consider the scheme in Figure 2, more complex than the former one:
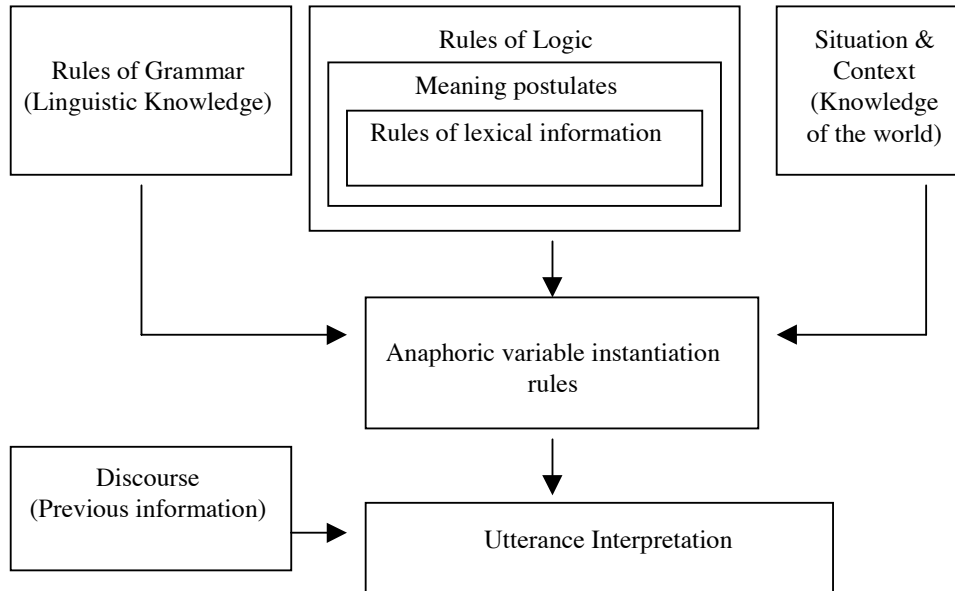

Figure 2

As it can be seen, the instantiation of anaphoric variables is considered as an intermediate module for the interpretation of utterances. Therefore, the interpretation of anaphora (pronouns, indefinite noun phrases, definite descriptions, relative clauses, spatial or temporal deictic terms, tense and aspect of verbs, etc.) is the common element for the confluence of the other modules. Hence the importance of anaphoric inference in DRT and another dynamic frames of discourse interpretation.

In the interpretation of discourse, it is rare to have a unique database for establishing its global meaning. Several related databases are usually needed to obtain a model. The given relations among representations or necessary databases for the evaluation of discourse utterances are far away from those in classical model theory. Conceived in this manner as linguistic databases, the different representations of discourse are similar to possible worlds. So they can be seen as *moments*, giving a temporal interpretation to discourse representations; or they can be seen as successive states of the speaker/hearer's mind, and then we have that discourse representations are similar to Kripke's *information states*. Whatever the case could be, the representations of discourse are interpreted as partial models of reality, and therefore they can be treated as *Hintikka sets* (Salguero 1994).

This perspective allows us dealing with discourse interpretation as a sort of logical calculus, a series of inferences on the successive representations of discourse that take the

hearer to the meaning of its constituent utterances. Such inferences depend on the rules of the grammatical and logical modules, and on the hearer's knowledge of the world. But there is even another decisive factor that intervenes in these inferences: *presuppositions*.

2 Presuppositions and DRT

The notion of presupposition has been discussed since Antiquity, without having reached a consensus about its linguistic or logical nature up to the day. We can see it as a semantic relation between sentences and define it saying that *a sentence B presupposes another sentence A if A implies B or if the truth value of A is a condition for the truth value of B*. It is also usual to understand the notion of presupposition pragmatically as a set of attitudes and notices, being used by language users in their speech acts. In this case, we refer to *speaker/hearer's presuppositions* instead of *sentence presuppositions*. But there is no opposition between these two perspectives because we can treat presupposition as a one more part of the interpretation of the utterances that constitute discourse in a concrete representation of its meaning, and then both perspectives are satisfied: the semantic and the pragmatic one.

This signifies that we will not find a well defined notion of presupposition in the specialised literature, but a set of linguistic data that must be explained in a theory about discourse interpretation (Levinson 1983). Typical examples of these linguistic data are sentences like:

(1) Have you stopped hitting your wife?
(2) The actual king of France is not bald

In (1) we have that the verbal aspect and the possessive *your* presuppose that the hearer has a wife and that he hits her. In (2) we are in front of a classical existence presupposition introduced by the definite determiner *the*. Both sentences are classical examples of presuppositions, but they are not the only ones. We can classify the linguistic elements that can be the source of presuppositions in discourse, following (Beaver 1997):

1. Definite noun phrases, introduced by the definite article, demonstratives or possessives, proper names or even relative clauses.
2. Quantified noun phrases, introduced by a quantificational determiner.
3. Factive verbs or verbal nouns and noun phrases related to them, such as *reject, know, the fact that, the acquaintance of*, etc. In this case we can distinguish between cognitive factives, related to the knowledge of the facts, and emotive factives, related to emotional attitudes towards the facts.
4. Clefts (it-, wh- or pseudo-clefts), like *It was not John who called you up*, presupposing *someone called you up*.
5. Wh-questions that presuppose the existence of an entity suitable for an answer, like *What colour is the snark?*, presupposing the existence of a "snark".
6. Counterfactuals, presupposing the falsity of the antecedent.
7. Lexical presuppositions. For instance, *dog* presupposes *animal*.
8. Action verbs, like *stop doing something*, aspectual or temporal modifiers, like *before* or *after* in certain sentences (v. gr.: *After having your breakfast, go out to school*, presupposing *you are having breakfast*).

9. Iterative expressions, like *again*, or the prefix *re-*, presupposing some kind of repetition.
10. Some discourse connectives, like *although, but, because*.

Casuistry is wide and we do not pretend to have a list with every source of presupposition in discourse. But we can see now that presuppositions in the sentences (1) and (2) depend on verbal aspect and tense, studied, for instance, in (Kamp & Reyle 1993:483f.), and on the interpretation of noun phrases and the quantificational scope of the determiners. This last one is the most usual source of existential presupposition in discourse and we will analyse it in this paper.

2.1 Accommodation of presuppositions in DRSs

It is evident, as we have mentioned before, that presuppositions play an important role in discourse interpretation. They are indeed a part in the semantic and logical structure of the discourse utterances and, therefore, they must appear in any representation of that structure. So we need a method for making presuppositions explicit in Discourse Representation Structures (DRSs), since they are the way in which DRT represents discourse interpretation. We are adopting van der Sandt's method, consisting in the explicit extension of discourse context in order to include in the correspondent DRS all the presuppositions intervening in the interpretation of the utterances (van der Sandt 1992, 1993). This method is called *accommodation*.

Accommodation consists in the addition of discourse referents and conditions to a DRS. This addition is made in any of the accessible representations that contain the discourse element that *triggers* the presupposition. When a trigger element causes a presupposition without an antecedent, accommodation will consist in the transference of discourse markers and conditions of the presupposition from the representation of the trigger to an accessible DRS. Therefore, we can distinguish among *local accommodation* (when the addition is made in the same DRS of the trigger), *global accommodation* (when the addition is made in the main DRS that includes all the other representations), and *intermediate accommodation* (when the addition is made in another DRS, different from the main one and accessible from the DRS where the trigger element appears) (van der Sandt 1992).
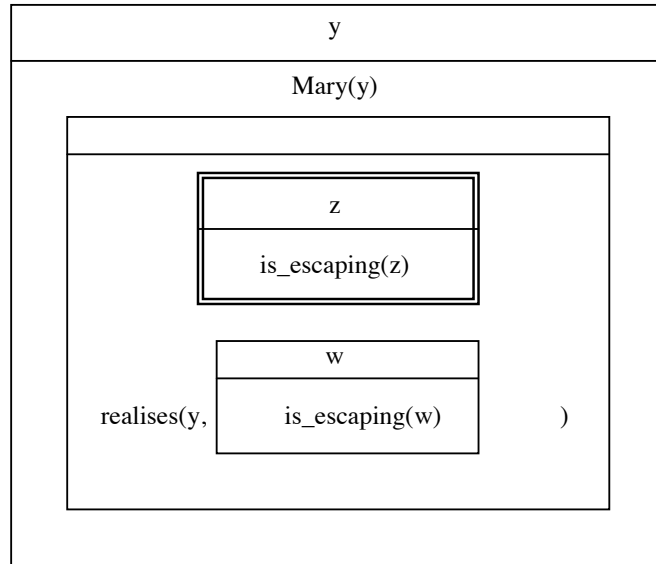
Triggers are seen as anaphoric elements in discourse interpretation because these elements cannot be interpreted with independence of the structural relation established between the position in which they are represented in a DRS and the place where the representations of their antecedents are: an accessible DRS, like in the case of pronominal anaphora's antecedents. Let us see an example taken from (Beaver 1997):

(3) Mary doesn't realise that somebody is escaping.

The correspondent DRS (DRS1) includes the presupposition *somebody is escaping*, that will be represented within a double line box. This presupposition marks the existence in the discourse universe of an individual z and verifies the condition *is_escaping(z)*. The marker w can be instantiated as z because the presupposition is accessible from its DRS. We can compare (DRS1) with the interpretation of the sentence (4), represented by (DRS2):

(4) Fred is escaping but Mary doesn't realise somebody is escaping.

(DRS1)

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┌─────────────────────────────────────────┐
│                    y                     │
├─────────────────────────────────────────┤
│                 Mary(y)                  │
│  ┌───────────────────────────────────┐   │
│  ├───────────────────────────────────┤   │
│  │   ╔═══════════════════════════╗   │   │
│  │   ║             z             ║   │   │
│  │   ╟───────────────────────────╢   │   │
│  │   ║      is_escaping(z)        ║   │   │
│  │   ╚═══════════════════════════╝   │   │
│  │                                   │   │
│  │        ┌──────────────────┐       │   │
│  │        │        w         │       │   │
│  │        ├──────────────────┤       │   │
│  │ realises(y, │ is_escaping(w) │  )  │   │
│  │        └──────────────────┘       │   │
│  └───────────────────────────────────┘   │
└─────────────────────────────────────────┘
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(DRS2)

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┌─────────────────────────────────────────┐
│                   x,y                    │
├─────────────────────────────────────────┤
│                 Fred(x)                  │
│              is_escaping(x)              │
│                 Mary(y)                  │
│  ┌───────────────────────────────────┐   │
│  ├───────────────────────────────────┤   │
│  │   ╔═══════════════════════════╗   │   │
│  │   ║             z             ║   │   │
│  │   ╟───────────────────────────╢   │   │
│  │   ║      is_escaping(z)        ║   │   │
│  │   ╚═══════════════════════════╝   │   │
│  │                                   │   │
│  │        ┌──────────────────┐       │   │
│  │        │        w         │       │   │
│  │        ├──────────────────┤       │   │
│  │ realises(y, │ is_escaping(w) │  )  │   │
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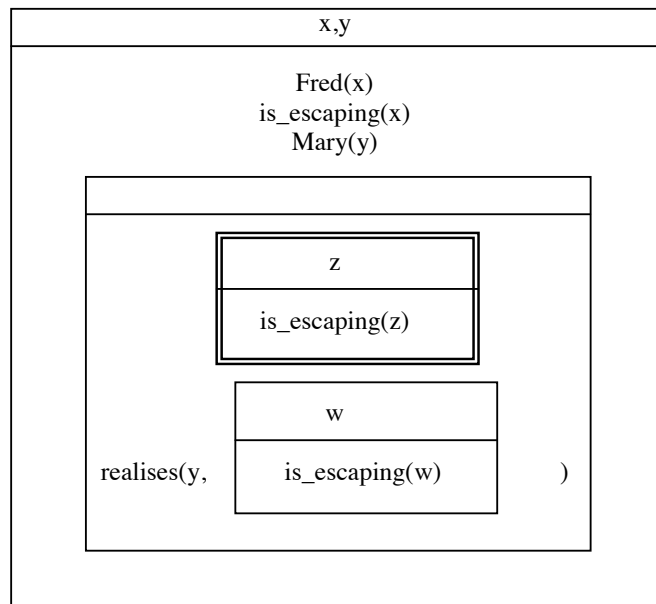
The main DRS in (DRS2) is accessible from the negated DRS, so the marker z can be instantiated by means of the marker x. Therefore, the universe of the presupposition can be

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reached from the global universe of discourse, as the condition of the presupposition is accessible like a global condition. This means that the presupposition has an antecedent and, therefore, as it does not play another role in (DRS2), it could be eliminated *salva interpretatione*. When we eliminate a presupposition by means of its resolution into an antecedent as in (DRS2), or when we accommodate it into a DRS accessible from the trigger's representation, we say that the presupposition is *cancelled*. But, how does the accommodation method work in relation with the presuppositions in a DRS? Consider the following sentence:

(5) If Mary chose the Sherry then she realises it is a good wine.

In the following DRSs, we will simplify the discourse markers using individual constants *m* and *s*, denoting *Mary* and *Sherry* respectively, and the bidimensional structure will be represented linearly for saving space in the page. Then, in (DRS3) the signs [and] are single line box limits and the signs { and } are double line box limits. An empty box [ ] means that there is no individual marker for that representation.

(DRS3) [[m,s] [[   ] chose(m,s)]   [[   ] { [   ] good_wine(s) } realises(m, [[   ] good_wine(s)])]]

In order to have a DRS where no presupposition appears without an antecedent, we must move the DRS representing the presupposition towards any of the sites that are accessible from the trigger's DRS, that is to say: from the representation of the sentence *Mary realises that the Sherry is a good wine*. This movement produces three different DRSs depending on the accommodation type:

Global accommodation: *The Sherry is a good wine and if Mary chose it, she realises it is a good wine*.
(DRS4) [[m,s] good_wine(s) [[ ] chose(m,s)]   [[ ] realises(m, [[ ] good_wine(s)])]]

Intermediate accommodation: *If the Sherry is a good wine and Mary chose it then she realises it is a good wine*
(DRS5) [[m,s] [[ ] good_wine(s) chose(m,s)]   [[ ] realises(m, [[ ] good_wine(s)])]]

Local accommodation: *If Mary chose the Sherry then it is a good wine and she realises it is a good wine*.
(DRS6) [[m,s] [[ ] chose(m,s)]   [[ ] good_wine(s) realises(m, [[ ] good_wine(s)])]]

Each one of these three DRSs supposes a different interpretation of the existing relation between the sentence (5) and the presupposed sentence *The Sherry is a good wine*. Now we can ask what kind of accommodation is the best one for the interpretation of an uterrance like (5) and try to establish a priority. First, we must try to instantiate the presupposition markers in the actual accommodation. That is what is called *resolution*. But resolution is possible only when we have accessible markers for the instantiation, from the DRS containing the presupposition trigger up to the main DRS. When we cannot find markers for the resolution then we must appeal to accommodation, but now going in the reverse way:

from the main DRS up to the trigger's DRS. This means the priority is resolution and then, when resolution is not possible, global accommodation, intermediate accommodation and finally local accommodation. This process has certain constraints that can be found in (van der Sandt 1992) or in (Beaver 1997).

2.2   Existential presuppositions and DRSs

We can now recover the classical example by Bertrand Russell to illustrate the treatment of existence presuppositions in DRT:

(2) The actual king of France is not bald

The problem for Predicate Logic is whether this sentence is true or false because there is no entity in the domain of discourse that could be considered as a good instantiation for the individual variable in order to satisfy the predicate *to_be_the_king_of_france*. Nevertheless, Russell said that the logical form of this sentence presupposes the existence of such an individual:

[2]   x(king_of_france(x)   bald(x))

It is evident that if [2] is true then we can infer [2'], that is to say: *There is a king of France*; but if [2] is false then we can infer [2"], that is to say: *All the kings of France are bald*.

[2']   x(king_of_france(x))
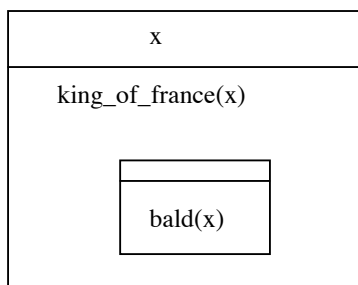[2"]   x(king_of_france(x)   bald(x)),

To avoid this kind of undesirable presuppositions, Russell proposed his theory of definite descriptions, introducing a logical operator   as a descriptor. In this theory, two possible scopes were postulated for negation: a restricted scope [2*] (corresponding to the global accommodation of the presupposition) and a general scope [2$^+$] (corresponding to the local accommodation):
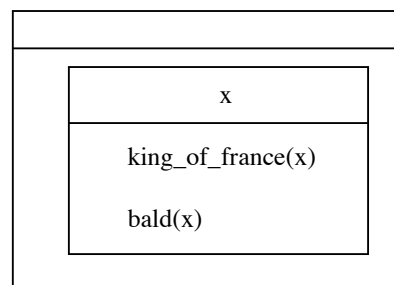
[2*]   x[king_of_france(x)](bald(x))
[2$^+$]   (x[king_of_france(x)](bald(x)))

(DRS7) **Global accommodation**:   (DRS8) **Local accommodation**:

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In ordinary discourse, to avoid the undesirable effect produced by the existential presupposition in (2), we can enrich our utterance with an explanation in the following way:

(6) The actual king of France is not bald. There is no actual king of France.

The corresponding DRS to (6) must include, however, the existential presupposition and deal with it in the adequate manner, resolving its discourse markers or accommodating it in the corresponding site inside the DRS:

(DRS9) [[ ]   [[ ] bald(x) { [x] king_of_france(x) }]   [[y] king_of_france(y)]]

The two possible accommodations for the presupposition in (DRS9), after leaving the possibility of resolution of the marker *x* aside, are the following ones:

(DRS10) [[x] king_of_france(x)   [[ ] bald(x)]   [[y] king_of_france(y)]]
(DRS11) [[ ]   [[x] bald(x) king_of_france(x)]   [[y] king_of_france(y)]]

(DRS10) represents the global accommodation of the presupposition and (DRS11) represents the local accommodation. But, between both options, we must prefer the local accommodation (DRS11), because the global accommodation (DRS10) contains a contradiction since we can resolve the marker *y* instantiating it in the marker *x* that appears in an accessible representation. Then, the existential presupposition is cancelled in (DRS11).

The addition of van der Sandt's accommodation theory to DRT to deal with presuppositions gives us certain advantages over other alternative theories. It includes, for instance, a resolution mechanism for anaphora we cannot find in the theory of definite descriptions. Moreover, it offers a criterion for distinguishing between different scopes of the presupposition and choosing the most adequate one in each case to cancel it. It also offers the possibility of treating in a different way the different presuppositions appearing in discourse, depending on the relations with their trigger elements and their sites inside the global DRS that represents their meaning.

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