PRESUPPOSITION & VP-ELLIPSIS*

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Abstract

We discuss a treatment of VP-ellipsis resolution in DRT in general, and particularly cases where the source clause of the elliptical VP contains presupposition triggers. We propose to restrain VP-ellipsis resolution by presupposition neutralization. We view presupposition as a kind of anaphora, with the ability to accommodate an antecedent if not provided by discourse.

1 Introduction

In this paper we discuss the treatment of VP-ellipsis resolution in general, and particularly its interaction with presupposition. We share the opinion of those who argue that ellipsis resolution should take place at a semantic level [Dalrymple *et al.*, 1991; Kehler, 1993; Sem, 1993]. We will provide a framework in which ellipsis resolution is constrained by presupposition projection, and furthermore, anaphora and presupposition are represented underspecified in the semantics.

The latter postulation is necessary for a proper treatment of VP-ellipsis on the semantic level. The source clause of an elliptical VP often contains presupposition triggers, and resolution of the elided VP asks for presupposition projection in the context of the *target* elliptical clause. This is an issue which has been neglected in the literature hitherto.

The other thesis we put forward in this paper is that VP-ellipsis resolution is constrained by presupposition. Every elided VP is evidently escorted by some presupposition trigger. The cases we will pursue through this paper is the presupposition introduced by focusing particles such as *too*.

Of our interest are examples like:

(1) John kicked his dog, and Tom did, too.

(2) With Betty, John visited her parents, and with *MARY*, he did, too.

Example (1) presupposes that only John owns a dog (in the strict reading), or presupposes that both John and Tom own a dog (in the sloppy reading). Example (2) shows that this strict/sloppy ambiguity also occurs in cases where there is a non-subject parallelism.

We use the level of discourse representation for VP-ellipsis resolution, in an extension of Discourse Representation Theory [Kamp, 1981]. For the reconstruction of elided material we adopt a version of Asher's *Concept Abstraction* mechanism [Asher, 1993].

We furthermore integrate Van der Sandt's presupposition projection algorithm [1992]. Van der Sandt argues that presuppositions are kind of anaphoric expressions which interpretation is strongly influenced by discourse structure. The main difference to pronouns is that presuppositions have more descriptive content, which enables them to *accommodate* an antecedent, in case not provided by discourse.

2 DRT-framework

In this section I will outline a proper framework that integrates anaphora resolution, presupposition projection, and ellipsis resolution. Basically, we will extend Kamp's Discourse Representation Theory slightly, by integrating the treatment of presupposition of Van der Sandt and reference to

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abstract entities by Asher. What is new is the combination of these three formalisms into one, leading to interesting results concerning the analysis of VP-ellipsis.

DRT focuses on the semantic interpretation of discourses. A major aspect of DRT is the use of *Discourse Representation Structures* that hold the semantic content of sentences as a pair $< U, C >$, in which U is a set of discourse markers (referents) and C a set of conditions upon them. The full syntax of DRSs is given in Definition 1.

Definition 1: DRS Syntax

1. If U is a set of reference markers, C a set of conditions, then the pair $< U_\Phi, C_\Phi >$ is a DRS Φ;
2. If P is n-place predicate constant and $t_1 \ldots t_n$ are terms, then $P(t_1 \ldots t_n)$ is a condition;
3. If Φ and Ψ are DRSs, then $\neg \Phi$, $\Phi \Rightarrow \Psi$ and $\Phi \vee \Psi$ are conditions
4. If Φ is a DRS, P a predicative DRS, t_1, t_2 are terms, then $\alpha(t_1,t_2):\Phi$, $\epsilon:P(t_1)$ and $t_1:\Phi$ are conditions.

Clause (2) forms atomic conditions. Clause (3) states negation, universal quantification, and disjunction. Clause (4) defines anaphoric, elliptical material, and propositions and deserves more attention because it deviates from Kamp's original proposal. In our framework we introduce the *alfa-condition* (α:Φ) which functions to indicate that the information in DRS Φ must be anaphorically linked to previously established discourse markers. It has two additional arguments, one for indicating the principal referent of the anaphoric construction, and (optional) one for stating the antecedent. So a condition $\alpha(x,y):\Phi$ states that y is the antecedent for x, under restriction of Φ.

In the case of pronouns, Φ only contains discourse markers and no conditions. But in the case of, for example, definite descriptions, Φ carries the restrictions in its conditions for linking the discourse marker associated to the definite description to an earlier introduced marker.

Referential constructions such as ellipsis and event-type anaphora, are not linked to discourse markers but, instead, refer to *portions* of discourse, and are indicated by ϵ: $P(t)$, where P is an abstracted piece of the previous DRS. Resolution of *epsilon-conditions* is done by applying the abstracted DRS P to its argument t.

Alfa- and epsilon conditions do not carry any subordination relations with respect to other DRSs, and neither do propositional conditions. They are, in contrast to the sub-DRSs formulated under clause (3), accessible for anaphoric relations and inherit the subordination relations of the DRS in which they are situated.

Ellipsis resolution is done by a process called C-Abstraction (cf. Asher 1993, p. 249). It is stated in a simplified form as:

Definition 2: C-Abstraction for VP-ellipsis (Asher)

1. If $\epsilon:P(t)$ is a condition in DRS K and is derived from auxiliary *do*, then P may be identified with $\lambda y.K^*$, where K^* is an alphabetic variant of a part of K.
2. K^* is underspecified for alfa- and epsilon-conditions.

While parsing a sequence of sentences, we assume the following: firstly, we have got a proper DRS of the sentences that we have parsed so far, and secondly, a compositional bottom-up construction procedure that returns the DRS of the actual sentence, which is called the sentence-DRS (henceforth s-DRS).

An s-DRS is in a sense underspecified, because all anaphoric material that it includes is still unresolved. On the representational level this is marked by leaving the optional slot in the alfa-condition for the antecedent unfilled. Anaphoric material contains, besides the 'normal' anaphors, also all presuppositional information of the sentence under consideration. Accordingly all presupposition inducers are marked as such in the lexicon.

3 Presupposition Projection

In this section we will show how presupposition projection (and hence, anaphora resolution) is treated in DRT. The algorithm I present is in essence conform to Van der Sandt's proposal [Van der Sandt, 1992]. Van der Sandt's theory is principally based on two mechanisms: *binding*

and *accommodation*. Compared to classical presupposition theories, the former corresponds by and large to presupposition cancellation (or better: neutralization), while the latter is sort of repairing the discourse in the style of Lewis [1979].

The idea of Van der Sandt's work is that "anaphoric expressions are either linked to some previously established antecedent or, if they have enough descriptive content, accommodated at some level of representation" [Van der Sandt, 1992]. All anaphoric information is resolved (under normal circumstances), conform the following rules:

1. Try to bind the anaphoric material to an accessible antecedent.
2. If (1) fails, accommodate an antecedent.

Accommodation must take place at some accessible level of discourse. It has been argued in the literature that accommodation must take place *as global* as possible. [Heim, 1983; Van der Sandt, 1992]. Rather than using a non-monotone *moving* operation for accommodation we obey the following algorithm:

1. If there is a superordinated level then (2) else (4).
2. Copy the presupposed information to this level, but only if this does not lead to semantic contradictions (unbound variables or inconsistencies) or pragmatic violations, else (4).
3. Repeat step (1).
4. Ready.

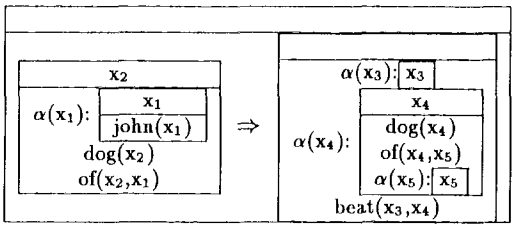
We will not elaborate in detail on the issue which constrains constitute the elimination of possible accommodation sites. The interested reader should consult Van der Sandt's paper (1992) for proposals.

We exemplify the projection algorithm with (3) and (4). The former presupposes John as a dog owner, the latter, in contrast, does not presuppose that, although it contains the same presupposition inducer. This is named the *the projection problem.*

(3) John beats his dog.

(4) If John has a dog, he beats his dog.

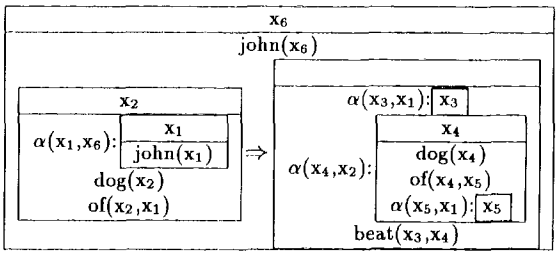
The result of the compositional semantic construction process for (4), given that presuppositions are marked in the lexicon as anaphorical, is the following s-DRS:



This s-DRS is merged with the DRS of the previous discourse, which is in this case an empty one. The next step is to examine the newly acquired conditions and see if there are any anaphoric DRSs among them.

In the first place we find the condition for the proper name *John*, which is treated as a presupposition. We cannot bind this expression to a referent, since there is none available, so we accommodate the information in the principle DRS.[1] Accommodation is simply fulfilled by copying an alphabetic variant of the anaphoric DRS to the main DRS. *Linking* is possible for the personal pronoun x_3 to the (closest) referent of *John*.

The other anaphoric DRS in the consequent of the implication paraphrases *his dog* has an embedded anaphoric DRS, which has to be resolved first. In this case the referent x_5 can be linked to x_1. Finally we can resolve x_4 to x_2 because their corresponding conditions do not conflict and yield:



This DRS is fully specified and paraphrases the meaning of (4) correctly: *There is a male person called John, and if John owns a dog, he beats it.* For (3), our algorithm would accommodate the information that John owns a dog.

[1] Note that proper names, treated as presuppositions, are always accommodated to the top level DRS this way, or linked to previously established markers.

4 VP-ellipsis Resolution by Presupposition Projection

We will explain our analysis of VP-ellipsis by example (5). Recall that (5) is ambiguous in whether Tom is beating John's dog (the strict interpretation) or Tom is beating Tom's dog (the sloppy reading).

(5) John kicked his dog. Tom did, too.

Our analysis heavily relies on the interpretation of focusing particles. No existing approach to VP-ellipsis does so, although absence of presupposition introducers makes interpretation of elided VPs impossible (6). The set of presupposition triggers I am referring to includes particles like *too, also, so, either*, discourse connectives *before, after, and, but* and other presupposition inducers such as certain focusing constructions.

(6) ? John kicked his dog. Tom did.

We will emphasize on the interpretation of focusing particles, especially, the adverb *too*. Discourse particles function to enhance the coherence of discourse. They do not add anything to the meaning of the propositions they modify, but rather judge whether a propositions fits within the previous context or not. This feature characterizes them as eliminators of possible readings in a given context. It makes it impossible to understand (5) as *John kicked Bill's dog, and Tom kicked Tom's dog*, for example.

The particle *too* typically is sensitive to focused objects. In words, too(ϕ), ϕ a proposition, presupposes ψ, with ψ a proposition derived from ϕ with the focused items in ϕ replaced by their alternatives. We follow Rooth [Rooth, 1985] in taking the function of focus to be evoking alternative sets. Focus determines in that respect an additional semantic value $[\![.]\!]^f$. Ordinary semantic values $[\![.]\!]^0$ are not affected by focus.

(7) $[\![\ \text{Tom}_{f,1}$ kicked his_1 dog$]\!]^f$ = the set of propositions of the form "x kicked x's dog"

(8) $[\![\ \text{Tom}_{f,1}$ kicked his_2 dog$]\!]^f$ = the set of propositions of the form "x kicked his_2 dog"

(9) $[\![\ \text{Tom}_{f,1}$ kicked his_1 dog$]\!]^0$ = the proposition "John_1 kicked his_1 dog"

Note that pronouns with focused antecedents (7) get a referential interpretation, and pronouns with an unfocused antecedent get a bound interpretation. The semantics of *too*, stated in terms of Rooth's *alternative semantics* is consequently:

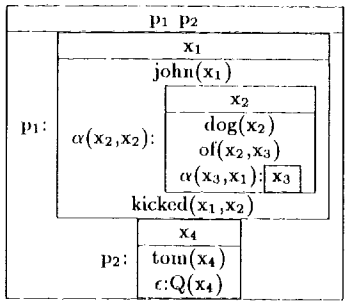
(10) too(Φ): $[\![\Phi]\!]^0 \oplus$ $\alpha(p)$: [p ; p:Ψ] $(\Psi \in [\![\Phi]\!]^f)$

The merge operation $\oplus$ takes two DRSs and returns a new one. The merging of DRSs consists in simply taking the union of the sets of discourse markers and the sets of conditions separately.

The alfa-condition in (10) introduces the presupposition of *too*. In order to preserve coordination between this presupposition and the assertion, it is necessary to perform ellipsis and anaphora resolution *before* the interpretation of proposition modifying particles can take place.

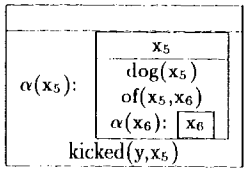
We will work out an example in detail to make clear how resolution is restrained by presupposition. Discourse markers of type x_i are used to range over individuals, markers of type p_i range over propositions. Consider (5), paraphrased in the following DRS:

(11)



By C-Abstraction (Def. 2) we derive the following predicative DRS for *kicked his dog*, which will be applied to the argument of the epsilon-condition in (11), x_4.

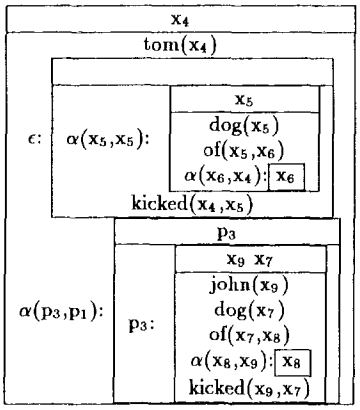
(12) $\lambda y.$



Note that (12) is underspecified for anaphoric relations. It will become part of a context distinct from its original one, and therefore other discourse markers may play the role of antecedents. The discourse marker x_6, standing for *his*, can be either linked to the marker corresponding to *Tom*, or to the marker corresponding to *John*. In the former case we get a *referential* reading in the presupposition because the antecedent is in focus position, in the latter case we get a *bound* reading. However, these possible readings[2] are *checked* for being allowed by the presupposition introduced by *too*.

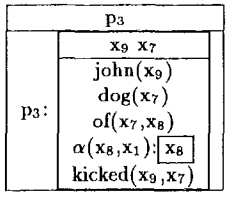
Applying (10) to the resolved propositional DRS p_2 with the referential reading gives us the presupposition in (13) which allows the sloppy interpretation of *Tom does, too*:

(13) p_2:



The presupposition p_3 can be linked to p_1 in (11) and is therefore not rejected. The resolved DRS with the bound reading in the presupposition gives us the strict interpretation of the elided VP. The presupposition stemming from *too* for this case is (14) and can also be linked to p_1.

(14) α:(p_3,p_1):



Given DRS (11), no other presuppositions can be satisfied and therefore these two readings are exhaustive. Because *linking* of presuppositions has in our framework a higher priority than *accommodation*, readings like *Tom kicked x's donkey*, where x does not equal *John* or *Tom*, are not allowed.

Finally, note that, for the definite description *his dog*, in the second case presupposition neutralization by anaphoric binding took place, while in the first case the presupposition was accommodated (by "assertion").

[2]Which number would be larger, if there were more suitable antecedents for x_6, more possible antecedents VPs, or more alternatives for the focused object *Tom*. However, none of these readings would fulfil the requirement to be an anaphoric presupposition!

5 Comparison to other Approaches

I classify previous approaches to VP-ellipsis resolution as 1) approaches that take the antecedent VP as ambiguous, 2) approaches that pursue a copying-and-renaming mechanism, and 3) approaches that rely on discourse relations. None of the approaches to be mentioned use *presupposition* as means to restrain VP-ellipsis resolution.

Source-clause Ambiguity Approaches

The first class of approaches to VP-ellipsis is characterized by claiming that the semantics of the elided VP is identical to another VP salient in discourse. They treat the source clause as ambiguous in cases where there is both a strict and sloppy interpretation possible. For illustration, our example (5) would allow only one of the two possible properties for the antecedent VP, respectively the referential and the bound interpretation.

(15) a) λx. kicked(x,dog_of(x))
b) λx. kicked(x,dog_of(john))

Resolution is simply done by choosing one of the possible sources given in (15) and apply it to the subject of the elliptical VP. This analysis is proposed in [Sag, 1976], [Williams, 1977], [Klein, 1987], [Roberts, 1987] and [Gawron and Peters, 1990] and are also termed "identity-of-relations" approaches in the literature.

The most serious problem that these approaches face is "the postulation of wild ambiguity in the source clause, one derivation for each possible case of subsequent ellipsis." [Dalrymple *et al.*, 1991]. Furthermore, it turns out to be impossible to hold

on to this analysis for cases like (16):

(16) With Betty, John visited her parents, and with *MARY*, he did, too.

Example (16) also shows the strict/sloppy ambiguity. Our analysis predicts this, since the focused object is *Mary*, and the presupposition stemming from *too* is either *with x, John did visit x's parents* (sloppy reading) or *with x, John did visit Betty's parents* (strict reading).

Copying-and-Renaming Approaches

On the other hand, there are the 'sloppy-identity', 'non-identity', or 'flexible-copying' approaches to the problem of ellipsis, which abandon the assumption that the source clause is ambiguous. Instances of these analyses are the *higher order unification and equational analysis* [Dalrymple *et al.*, 1991], role-based copying methods [Kehler, 1993], and few posited in Discourse Representation Theory [Bäuerle, 1988]; [Sem, 1993]; and Kamp (Personal communication of Kamp to Gawron & Peters [Gawron and Peters, 1990]).

Their shortcomings are, generally stated, first that they are forced to put additional, intricate constraints on resolution to omit overgeneration of readings. Second, these approaches do not include a detection of parallelism. They take the identification of parallel objects for granted, or assume that the subjects of the source and target clauses are parallel (which is not necessarily the case, see e.g. (16)). A proper treatment of ellipsis requires the integration of parallelism detection between the source and target clause.

Our approach can also be classified as a copying-and-renaming approach, with the difference that it uses presupposition neutralization as a natural constraint rather than using "artificial" constraints to restrict resolution. Copying-and-renaming analyses generally have better predictions than source-clause-ambiguity approaches. The following example, for instance, is judged to have five readings:

(17) John revised his paper before the teacher did, and Bill did, too.

Our analysis generates (assuming that *before* introduces a similar presupposition as *too*), when the embedded elided VP is strictly interpreted, two readings (the corresponding presuppositions are x revised x's paper before t revised t's paper, and x revised j's paper before the t revised t's paper) and three readings when the embedded elided VP is sloppily interpreted (here the corresponding presuppositions are: x revised x's paper before t revised x's paper, x revised j's paper before t revised j's paper, and x revised x's paper before t revised j's paper). These are exactly the same readings as [Dalrymple *et al.*, 1991], [Kehler, 1993] and [Sem, 1993] get in their analysis.

Analyses using Discourse Relations

A quite distinct class of approaches to VP-ellipsis are those that use discourse structure to restrain resolution [Asher, 1993; Gardent, 1993; Prüst and Scha, 1990]. These merely built on frameworks stemming from AI of whom the most famous one is Grosz & Sidner's Discourse Structure Theory [Grosz and Sidner, 1986]. In order to identify the underlying segments of discourse and their relations that hold between them, interpretation of clue words (linguistic expressions that indicate boundaries between discourse segments) and the purpose of the speaker is taken into account. Also, one might need knowledge of the world in the analysis of segmentation.

A general problem that these approaches face is that they heavily rely on discourse relations. There definition is "notoriously elusive" [Gardent, 1993], and an exhaustive classification is still subject to future research. Although cue phrases play an important role in signalling topic changes in discourse, in general another mechanism might be needed to find connections which are not clearly stated. The use of speaker's intentions might be necessary but in general there is no finite set of possible intentions available [Grosz and Sidner, 1986]. Another problem is the difficulty of finding a general way to incorporate world knowledge in a working system.

It is unclear in how far one needs discourse information for ellipsis resolution. An interesting future research topic is how far *presupposition*, as proposed in this paper, can support this task. Take for example:

(18) If John beat his donkey, Bill will too, but if he doesn't, Bill won't either.

Although source-clause-ambiguity approaches predict the right two readings for (18), it is unclear how copying-and-renaming analyses would eliminate any mixed strict/sloppy readings without using discourse relations like *contrast* and *parallelism*.

6 Conclusion

We proposed to perform VP-ellipsis resolution on a semantic representation level, in a DRT-style framework. We did so by incorporating a Van der Sandtian approach to presupposition projection. This gave us means to treat interactions of VP-ellipsis with presupposition, in such a way that we do not need any intrinsic rules that traditional copying strategies use for VP-ellipsis resolution. In this respect, emphasis was laid upon the presupposition introduced by the particle *too*, although the analysis of other discourse particles is not expected to be much different.

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