Accent Interpretation, Anaphora Resolution and Implicature Derivation

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Introduction

In many textbooks on logic which have been written in this century (e.g., Copi, 1972), there is a section dealing with the fallacies. It is customary that such a section contains a few lines on accent[2] stating that accent is a source of fallacious reasoning. This claim is then supported by the observation that accent influences the meaning of a sentence. Take the injunction in (1).

(1) We should not speak ill of our friends.

Normally, (1) is not intended to incite the listener to speak ill of those people who are not his or her friends. An accent on 'our friends' does, however, change the meaning of the sentence in this direction. In the aforementioned textbooks, a remark on accent such as this one is usually presented as part of a discussion on informal logic which which bears little or no relation to the material on formal propositional and predicate logic in the same book. This situation is owing to the fact that differences in meaning related to accent have for a long time resisted formalization.

Since the inception of Discourse Representation Theory (DRT; Kamp, 1981; Kamp & Reyle, 1993), the situation has changed. DRT provides a formal basis for dealing with the meaning of accent. Here I want to mention two contributions which exemplify the advances that have been made in this area.

Firstly, there is Van Deemter (1994a), which deals with the influence of accent on *anaphora resolution*. Consider (2), where accent is indicated with italics.

(2) a. John fed the animals. The cats were hungry.

b. John fed the animals. *The cats* were hungry.

Before presenting Van Deemter's analysis, let us introduce the following abbreviation: if e is an anaphoric expression, then $\mathcal{R}(e)$ stands for the (discourse) referent of e. Roughly speaking, (2.a) corresponds to a reading where $\mathcal{R}$(the cats) = $\mathcal{R}$(the animals), i.e., the referents coincide, whereas (2.b) reads $\mathcal{R}$(*the cats*) $\subset$ $\mathcal{R}$(the animals). Van Deemter explains these observations by positing that accent on an anaphoric expression indicates a non-identity anaphor.[3]

Secondly, there is Rooth (1992), which contains a formalization of the idea that accent induces *contrast between alternatives*. Imagine that the following conversation takes place after an exam which Mats, Steve and Paul took.

(3) George: How did it go?
Mats: Well, *I* passed.

[1]Thanks are due to Kees van Deemter, Emiel Krahmer, and the participants of the 'Information Packaging' seminar at IPO and the 'Questions under Discussion' workshop in Amsterdam for discussion and comments.

[2]We take (pitch) accent (also referred to as *intonational focus*) to be the highlighting of an expression by prosodic means. Differences in accent type are not dealt with in this paper.

[3]Note that Van Deemter's approach employs standard DRT. In this respect, it differs from, for instance, Vallduví (1992). Vallduví uses Heim (1982)'s file cards instead of Kamp's DRSs to account for the meaning of accent. The former contain more structure. Hendriks & Dekker (1995) show that such additional structure is superfluous.

In this situation, George seems licensed to infer that Steve and Paul did not pass the test. Rooth explains this by associating sentences with a so-called focus semantic value in addition to the ordinary semantic value (which is the proposition expressed by the sentence). In this case, the focus semantic value corresponds to the set of propositions of the form x passed (i.e., the alternatives to the proposition that the speaker actually expressed). The inference that Steve and Paul did not pass is now explainable using the Gricean quantity implicature (Grice, 1975). The idea is that there is a scale on the set of propositions x passed. By asserting the proposition 'Mats passed', Mats denies all propositions which are higher on this scale (i.e, the stronger propositions 'Mats and Steve passed', 'Mats and Paul passed', 'Mats, Paul, and Steve passed'). Rooth applies his theory to several other empirical domains (such as focusing adverbs and bare remnant ellipsis) which are beyond the scope of this paper.

The theories of Van Deemter (1994a) and Rooth (1992) account for different data. It is not immediately obvious whether there exists one theory which covers all the data. We think that one aspect of Rooth's theory that we did not yet discuss provides a starting point for such a theory. Consider:

(4) An *American* farmer met a *Canadian* farmer.

Rooth notes that the relation between the ordinary semantic value of '*American* farmer' and '*Canadian* farmer' (and vice versa) is subject to the constraints which also apply to presuppositions. More specifically, according to his theory the ordinary semantic value of the one should be a member/subset of the focus semantic value of the other (e.g., $\lambda x(\mathrm{american}(x) \wedge \mathrm{farmer}(x)) \in \lambda x(\mathrm{P}(x) \wedge \mathrm{farmer}(x)))$.

In this paper, we take a more radical stance: we assume that an accent on definites and indefinites induces a genuine 'alternative' presupposition.[4] For instance, 'The *american* farmer' is associated with the following two presuppositional boxes:[5] $[x \mid \mathrm{american}(x), \mathrm{farmer}(x)]$ and the alternative presupposition $[x \mid \mathrm{farmer}(x)]$. Both presuppositions behave as described in Van der Sandt (1992): they can be bound or accommodated. We propose two conditions on the relation between alternative and actual referents of accented (in)definites. The conditions are motivated by the contrastive function of accenting.

In the next section, the details of our proposal are spelled out. In the final section, we describe the differences with the theories of Van Deemter (1994a,b) and Rooth (1992). We conclude that our proposal covers both the non-identity anaphora and contrastive configurations data using DRT.

The Proposal

Before we present the core of our proposal, let us first sketch how presuppositions can be dealt with in DRT. We assume that the reader is already familiar with DRT itself.

PRESUPPOSITIONS In Van der Sandt (1992), presuppositions (which are triggered by, for instance, definites such as 'the car') are dealt with like anaphoric pronouns in DRT. Consider (5.a) and the corresponding (somewhat simplified) unresolved Discourse Representation Structure (DRS) in (5.b).

(5) a. If John buys a Ferrari, the car must be cheap.

b. $[\mid [x \mid \mathrm{Ferrari}(x), \mathrm{buy\_john}(x)] \Rightarrow [\mid \mathrm{cheap}(y)[y \mid \mathrm{car}(y)]]]$

[4] We think that our account can be extended to other quantifiers. They are, however, beyond the scope of this paper.

[5] The notion of a presuppositional box comes from Van der Sandt (1992).

The presupposition trigger 'the car' has introduced a so-called presuppositional box ($[y \mid \text{car}(y)]$) into the consequent of the DRS. The idea is that this presuppositional box needs to be resolved, i.e., bound by a suitable and accessible antecedent. Given the background knowledge that Ferraris are cars, the x is such an antecedent. The resolved representation of the sentence is obtained by substituting x for y and removing the presuppositional box (the result can be paraphrased as 'If John buys a Ferrari, it must be cheap'):

(6) $[\mid [x \mid \text{Ferrari}(x), \text{buy\_john}(x)] \Rightarrow [\mid \text{cheap}(x)]]$

Alternatively, if no suitable and accessible antecedent is available, the presuppositional box can be added to the main DRS or a subordinate DRS on the path between the source of the presupposition and the main DRS. This is known as *accommodation*.

Whether a discourse referent is a suitable antecedent depends on many factors. Here we will consider only one constraint which is required further on in this paper.

We assume that discourse referents can stand both for individuals and sets of individuals (e.g., *john* vs. *the cats*). Some of the aforementioned referents will be literal members of the main DRS, whereas others can be obtained from the explicitly present referents via function application. Generally speaking, there will be functions which relate one set/individual to another associated set/individual. For instance, *children* could be a function which when applied to an individual, returns the set of all her/his children. Similarly, *daughters* would return the set of all daughters of the person in question. Furthermore, it will be useful to have functions which given a set S, return a set S' such $S' \subset S$.

Now consider the following discourse, and in particular the presupposition trigger 'His children':

(7) John is a nice guy. His children are just like him.

Suppose, that the set of John's children is not explicitly present in the main DRS. The hearer has to find a set of individuals associated with John, such that for each of the individuals it holds that it is child of John. Amongst the possible candidates are the set of all of John's children, but also all its non-empty subsets. We have to ensure that 'his children' selects the set containing all of John's children (since this seems to be the natural reading of (7)). The following condition accomplishes this (*cf.* Van Eijck, 1983):

(C0) Maximality Condition *Only sets which are maximal with respect to the descriptive content of a presupposition trigger can fill the gap introduced by the presupposition. A set S is maximal with respect some descriptive content D, if it holds that* $\forall x \in S : D(x) \wedge \neg(\exists S' : S \subset S' \wedge \forall x \in S' : D(x))$.

We have considered the construction of new referents out of explicit referents. Needless to say that this procedure can be iterated. We do, however, assume that the more steps it takes to arrive at a referent, the less accessible it becomes. In Discourse Representation Theory, a referent is either accessible or not, depending on its relative position in the DRS. Ariel (1990), amongst others, discusses *accessibility degrees* which referents can have. The degree of accessibility is influenced by factors such as the distance between anaphor and antecedent, the fact whether an object is the discourse topic, parallelism, plausibility, etc.

ALTERNATIVE PRESUPPOSITIONS We start from the assumption that accent is a means for indicating contrast. We understand contrast in discourse as *binary*:

one discourse referent is contrasted with another discourse referent. Furthermore, we contend that only distinct discourse referents can be contrasted with each other. Distinctness is defined as follows:

(D0) Distinctness *Two referents a and b are* distinct $\Leftrightarrow$ **(1)** *If a and b are sets, then $a \cap b = \emptyset$;* **(2)** *If a and b are individuals, then $a \neq b$;* **(3)** *If a is an individual and b a set, then $\neg(a \in b)$.*

In case of an accented (in)definite, a contrast is induced between the actual referent of the (in)definite, and the referent of the alternative presupposition. The alternative presupposition is computed by removing all conditions in the actual presupposition which descended from accented material. For example, the alternative presupposition of 'The *cats*' corresponds to $[x \mid]$, which is computed by erasing $\mathrm{cat}(x)$ from the representation of the actual presupposition: $[x \mid \mathrm{cat}(x)]$ (in this case, the presuppositional box is technically the same as that of a pronoun).

There are two conditions which an actual referent and its alternative referent have to satisfy. Firstly, they should be distinct:

(C1) Distinct Referents Condition *For an actual referent a and the corresponding alternative referent b, it holds that a and b are distinct.*

Secondly, the discourse referent of the alternative presupposition should be equally or more accessible than the actual referent of the (in)definite.

(C2) Marked Accessibility Condition *If a is the actual referent and b the corresponding alternative referent, then: $acc(a) \leq acc(b)$ (where acc stands for accessibility of).*

The idea behind (C2) is that accenting an expression puts it in opposition to its unaccented (unmarked) variant. An accent which marks an expression signals that the meaning of the expression is also marked. For an anaphoric expression, marking guides the hearer to the marked (less accessible) referent.

Let us now reconsider example (2.b). Assume that a is the (set) referent introduced by the definite 'the animals'. We are now going to examine the possibilities concerning the identity of the actual referent c of *the cats* and the alternative referent o.

1.	$a \cap c = \emptyset$: c has to be accommodated.	
2.	$a = c$	(i) $o \subset a$, $o = a$, $a \subset o$ or $a \cap o \neq \emptyset$: violation of C1.
		(ii) $a \cap o = \emptyset$: accommodation of o: violation of C2.
3.	$a \subset c$	(i) $o \subset a$, $o = a$, $a \subset o$ or $a \cap o \neq \emptyset$: violation of C1.
		(ii) $a \cap o = \emptyset$: accommodation of o: violation of C2.
4.	$c \subset a$	result: by (C2) $o \subset a$; by (C0) $a = c \cup o$; by (C1) $a \cap o = \emptyset$.
5.	$a \cap c \neq \emptyset$ (and not 2.,3. or 4.): violation of C0.	

Only the possibilities 1. and 4. satisfy all the conditions. Solution 1. yields a reading where '*the cats*' are distinct from 'the animals'. Solution 4. gives us the subset reading: '*the cats*' are a subset of 'the animals'. In this case, the interaction between the conditions C0, C1, and C2. ensures that the set of animals is 'split up' between c and o.

Note that 2(ii) and 3(ii) are ruled out by condition C2: one cannot contrast a referent with a referent which has to be accommodated, because such a referent is not accessible.[6]

[6]There is a hedge: a referent may be accommodated and later get more specified, as in

We have illustrated how our proposal accounts for the interaction between accent and anaphora resolution. Let us now turn to implicature derivation. The idea is very simple: the implicature is the *denial* of the asserted proposition in which the alternative referent has been substituted for the actual referent.[7]

For (2.b), we compute on the basis of *the cats (amongst the animals) are hungry* the implicature that *the other animals are not hungry.* Of course, implicatures are defeasible. If subsequently, the speaker says '*The dogs* were, too', the aforementioned implicature is cancelled. For example (3), we get that *Steve and Paul did not pass.* We assume that the accent on '*I*' introduces an alternative referent for of the other relevant individuals at that point in the conversation (in this case, Steve and Paul).

Comparisons

Let us first compare our proposals with Van Deemter's non-identity account and a related account presented in Hendriks & Dekker (1995). Consider the following example.

(8) The children and their parents went to the fair. *The children* enjoyed it.

Note that the accent on '*the children*' seems at first sight not explainable in terms of non-identity anaphora, since a referent for the children is introduced in the first sentence of (8). One could, however, argue that there is a non-identity anaphor anyway, because we should think of 'The children and their parents' as introducing one referent.[8] But now consider:

(9) The children and their parents went to the fair. The *small* children enjoyed it.

How is it possible that 'children' receives no accent in the second sentence. Van Deemter (personal communication) argues that this is due to the concept givenness of 'children'. But then again, '*children*' is also concept given in (8). Van Deemter (personal communication) argues that this might mean that the examples need a different analysis in the spirit of (Van Deemter, 1994b) which deals with contrast in terms of contrariety. This means that we need to abandon the idea of a unitary explanation for the relatively similar examples (2), (8) and (9). Thus Hendriks & Dekker (1995)'s claim that they provide a theory which covers both the data on anaphora resolution and contrast becomes problematic. Note that for our approach, the examples present no problem. For (8), there is an alternative presupposition which can be bound by $\mathcal{R}$(The parents), and for (9), there is an alternative presupposition which can be bound by a set consisting of the children that are not small (the implicature is that these children did not enjoy the visit to the fair).

Furthermore, we would like to compare Van Deemter (1994b)'s treatment of contrastive accent with ours. Consider the following example from Van Deemter (1994b):

(10) *John* is married to *Mary* and *Peter* is married to *Sally.*

'*John* liked her. *Peter* didn't.', where $\mathcal{R}(Peter)$ can bind the alternative presupposition of '*John*').

[7] In case of multiple accents within an assertion, we obtain a set of implicatures, by following the aforementioned rule for each accented position separately. Furthermore, we assume that the denial of an assertion involving a distributive predicate distributes over the members of the set type arguments: the denial of $P(a)$, where P is a distributive predicate, corresponds to $\forall x \in a : \neg P(a)$. In this paper, there is no room to go into some refinements which are needed to predict the correct implicatures for accented indefinites.

[8] Van Deemter and Hendriks (personal communication) tend towards this solution.

Van Deemter proposes that contrast is licensed by contrariety between the conjuncts (possibly with substitutions of arbitrary variables for corresponding accented positions). Since there is no direct contrariety between 'a is married to *Mary*' and 'a is married to *Sally*', Van Deemter assumes that an implicature might be generated that the sentence is uttered in a monogamous society, thus obtaining a contrariety after all. We think, however, that even in a non-monogamous society we get the implicatures that John is not married to Sally and Peter is not married to Mary (which follow directly from our account). It is impossible to get these directly via Van Deemter's proposal: if there is no direct contrariety, he is always forced to assume that an interpreter 'accommodates' some 'rule' (i.e., 'monogamy': 'if a is married b and $c \neq b$, then a is not married c') which enables the derivation of a contrariety. It is not clear what 'rule' an interpreter would need to come up if she or he knows that the society in question tolerates polygamy.

Finally, let us discuss the relation of our proposal to Rooth's alternative semantics. Our proposal can be seen as an amendment of the latter. In particular, we propose that accent induces an alternative presupposition which seeks a referent of the same type as the actual referent of the accented definite or indefinite. Note that according to Rooth (1992, fn. 8) an accented adverb yields a discourse referent of property type, whereas the referent of the indefinite in which the adverb occurs is of individual type. Because in our proposal the actual and alternative referent are of the same type, we can account for the interactions between presuppositions and accents via the conditions (C1) and (C2). Note that instead of Rooth's alternative semantic values we use DRSs together with presuppositional boxes. The latter are removed from the semantic representation of the utterance during the interpretation process.

It is only fair to say that Rooth's theory accounts for many more phenomena which were not dealt with in this paper. It is an open question whether the proposal covers all the other empirical domains dealt with in Rooth (1992).

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