

PROCESSING DESCRIPTIONS*

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Abstract: The first part of this paper discusses the relative merits of Russell's and Strawson's view on the proper treatment of descriptive phrases. I argue that Russell's account is in principle correct, but is incomplete as it stands. The theory should be extended with an account of the intuition that gave rise to Strawson's (and Frege's) alternative in the first place. In the second part of this paper I present such an account in the 'presupposition as anaphora' framework. I show that if we treat Russellian descriptions as anaphoric expressions and when we implement such an account in a dynamic framework distinguishing between input and output contexts, his basic claim, definites should not be analysed as referring but as descriptive phrases, can be maintained while simultaneously accounting for the Frege/Strawson intuition.

Key-words: Anaphora. Discourse representation theory. Dynamic interpretation. Presupposition. Theory of descriptions.

The truth of the matter . . . is that Russell's analysis is correct, but needs to be supplemented by an account of the conventions relating to the *dynamics* of discussion or argument . . . (Wilfred Sellars 1954, p. 207)

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1. INTRODUCTION

In 1905 Bertand Russell launched his famous theory of descriptions, thereby fertilising philosophy with the highly influential idea that the grammatical form of natural language sentences may differ significantly from their underlying logical form.¹ According to this theory, the logical form of a sentence like ‘The present queen of the Netherlands wears a wig’ does not contain a constituent corresponding to the grammatical subject; the underlying form is a quantificational construct which is true just in case there is, presently, a queen of the Netherlands, there is just one, and this individual wears a wig. If one of these conditions is not met, the sentence is false. Thus, the descriptive phrase ‘the present queen of the Netherlands’ is not to be analysed as a singular term requiring a reference object for the sentence that contains them to have a truth-value. This runs counter to the views of Frege (1892) and Strawson (1950, 1952), who analyse such expressions as singular terms and have it that a sentence lacks a truthvalue in case the grammatical subject has no reference.

In the language of *Principia Mathematica* a descriptive phrase is rendered as an expression of the form $\iota x \varphi$, where ιx is the description operator and φ , its body, an arbitrary formula. The description-sign ι comes, just like a quantifier, with a variable, which serves to bind further variables in its scope; and just like a quantifier the description-operator takes a formula. But unlike quantifiers, the result of prefixing the description operator to a formula does not yield a formula but a term. In the logical language a description may thus occur in any position where we might also find an individual constant. This term forming procedure gives us

¹Of course, the idea that grammatical and logical form don’t coincide is a direct consequence of Frege’s discovery of quantifiers, which antedates Russell’s work with more than 20 years. It was Russell, however, who – by developing and promoting his theory of descriptions – formulated the idea in an much more explicit form and deeply influenced analytical philosophy for years to come.

terms of arbitrary complexity. For, since the material in the body of the description is a formula, we may exploit the full power of predicate logic to encode the internal structure of a descriptive phrase. This allows for descriptive phrases like e.g. (1),

- (1) a. the boy who danced with all girls
 b. $\iota x[\text{boy}(x) \wedge \forall y[\text{girl}(y) \rightarrow \text{dance}(x, y)]]$

where we find a quantified construction in the body of the description. It also allows for embedding of descriptions inside other descriptions as in (2),

- (2) a. the man who honoured the queen
 b. $\iota x[\text{man}(x) \wedge \text{honour}(x, \iota y \text{ queen}(y))]$

and, most importantly, it respects the fact that – in natural language – descriptive phrases may contain pronouns which can link up to external antecedents of any type. An example is (3a), where the pronominal *his* depends on the quantified phrase *every boy*. The logical representation reflects this, since the description contains a variable which is locally free and bound by the universal quantifier.

- (3) a. Every boy kissed the girl who loved him.
 b. $\forall x[\text{boy}(x) \rightarrow \text{kiss}(x, \iota y[\text{girl}(y) \wedge \text{love}(y, x)])]$

The expressive power of the language of descriptions thus goes way beyond the paradigm cases featuring the present king of France, a merit of Russell's theory that has been extensively been discussed by Mates (1973) and Neale (1990).

On Russell's account the ι -operator is not part of the official language. There is consequently no semantic definition of this operator and descriptions have no meaning in isolation. Russell's definitions allow us, however, to translate any sentence which contains one or more descriptions, into a description free formula.

Thus (1b) and (2b) have no interpretation unless they are part of a full sentence, and (3b) gets its interpretation indirectly by a translation in a description free predicate logic. The truth conditions of (3b) are just those that the standard semantics of predicate logic assigns to (4):

$$(4) \quad \forall x[\text{boy}(x) \rightarrow \exists y[\forall z[[\text{girl}(z) \wedge \text{love}(z, x)] \leftrightarrow z = y] \wedge \text{kiss}(x, y)]]$$

The original constructs can best be seen as providing convenient abbreviations for complex – description free – formulas. And the interpretation of the former is given by the semantics of their description free expansions.

In the source language descriptions may occur in the scope of any operator. In such environments the unexpanded version will normally be ambiguous as to the scope of the description and the embedding operators. Thus, without any further indication as to the scope of a description, this gives us underspecified structures that may be expanded in various ways. (5) for example is two way ambiguous and may be rewritten to either (6a) or (6b):

$$(5) \quad \neg \text{bald} \ \iota x \ \text{kf}(x)$$

$$(6) \quad \begin{array}{l} \text{a.} \quad \neg \exists x[\forall y[\text{kf}(y) \leftrightarrow y = x] \wedge \text{bald}(x)] \\ \text{b.} \quad \exists x[\forall y[\text{kf}(y) \leftrightarrow y = x] \wedge \neg \text{bald}(x)] \end{array}$$

And (7b) where we find yet another embedding, is three way ambiguous. It may be expanded to either (8a), (8b), or (8c):

$$(7) \quad \begin{array}{l} \text{a.} \quad \text{If baldness is curable, the king of France is not bald.} \\ \text{b.} \quad \text{curable} \rightarrow \neg \text{bald} \ \iota x \ \text{kf}(x) \end{array}$$

$$(8) \quad \begin{array}{l} \text{a.} \quad \text{curable} \rightarrow \neg \exists x[\forall y[\text{kf}(y) \leftrightarrow y = x] \wedge \text{bald}(x)] \\ \text{b.} \quad \text{curable} \rightarrow \exists x[\forall y[\text{kf}(y) \leftrightarrow y = x] \wedge \neg \text{bald}(x)] \\ \text{c.} \quad \exists y[\forall x[\text{kf}(x) \leftrightarrow x = y] \wedge [\text{curable} \rightarrow \neg \text{bald}(x)]] \end{array}$$

To avoid ambiguous expression in the source language Russell introduces scope indicators to mark the relative scope of a description. The description is marked (here by enclosing it in braces)

and may be recopied to the left of any subformula that contains the description. Thus (9a) abbreviates (6a) and (9b) abbreviates (6b):

- (9) a. $\neg \{ \imath x \text{ kf}(x) \} \text{ bald } \imath x \text{ kf}(x)$
 b. $\{ \imath x \text{ kf}(x) \} \neg \text{ bald } \imath x \text{ kf}(x)$

And (10a), (10b) and (10c) similarly abbreviate (8a), (8b) and (8c):

- (10) a. $\text{curable} \rightarrow \neg \{ \imath x \text{ kf}(x) \} \text{ bald } \imath x \text{ kf}(x)$
 b. $\text{curable} \rightarrow \{ \imath x \text{ kf}(x) \} \neg \text{ bald } \imath x \text{ kf}(x)$
 c. $\{ \imath x \text{ kf}(x) \} [\text{curable} \rightarrow \neg \text{ bald } \imath x \text{ kf}(x)]$

If the description outscopes the full formula – as in (9b) and (10c) – it is said to have primary occurrence, otherwise the occurrence is called secondary.

The famous definitions are *14.01 and *14.02 of Whitehead and Russell's *Principia Mathematica* (1910). The first allows us to translate a formula ψ which contains a description $\imath x \varphi$ to a formula from which the description is eliminated. *14.02 does a similar job for existential sentences (in the description language the symbol $E!$ translates 'exists'). In modern notation their definitions run as follows:²

$$*14.01 \quad \{ \imath x F(x) \} G \imath x F(x) =_{\text{def}} \exists x [\forall y [F(y) \leftrightarrow y = x] \wedge G(x)]$$

$$*14.02 \quad E! \imath x F(x) =_{\text{def}} \exists x \forall y [F(y) \leftrightarrow y = x]$$

By applying *14.01 and *14.02 until each description has been eliminated we may translate the formulas of the description language into standard description free predicate logic. Assuming that the scope of each description has been indicated in advance the

²Or, more precise and general:

$$*14.01 \quad [\imath x \varphi / z] \psi =_{\text{def}} \exists z [\forall x [\varphi \leftrightarrow x = z] \wedge \psi]$$

$$*14.01 \quad E! \imath x \varphi =_{\text{def}} \exists z \forall x [\varphi \leftrightarrow x = z]$$

provided that $\imath x \varphi$ is free for z in φ .

description language so gets, albeit indirectly, a non-ambiguous interpretation.

2. THE PRESUPPOSITIONALIST ATTACK

Strawson (1950, 1952) (followed by Searle (1969) and many others) famously attacked Russell on two counts. One line of attack concerns the way descriptions are used, the other their semantics.

The basis of the first line of attack is the distinction between (i) the use of an expression to refer uniquely, and (ii) the assertion that there is a unique individual that satisfies certain properties. The argument comes in various forms. A typical version runs as follows. When uttering ‘The king of France is wise’ we typically perform the speech act of assertion. And, in doing so, we use the description to refer to a certain person and we assert of this person that he is wise. The assertion that the person referred to is wise thus depends on a prior act of reference. This conflicts with the Russell’s analysis who – according to Strawson – would be committed to the claim that ‘... anyone who utters the sentence [The King of France is wise] would be jointly *asserting* [my italics] three propositions ...’ (Strawson 1950, p. 324). Most importantly, part of what he asserts would be that there is a unique king of France. Russell thus confuses ‘(1) using an expression to make unique reference; and (2) asserting that there is one and only one individual which has certain characteristics.’ (ibid., p. 334).

Though – as far as the pragmatics of descriptions goes – the argument has a certain intuitive appeal, it suffers from an unfortunate ambiguity in the notion of ‘statement’. Throughout his argument Strawson uses the expressions ‘statement’ and ‘assertion’ interchangeably. As to his notion of ‘statement’ Strawson stresses that ‘statements’ and not sentences are the bearers of truth-values. What statement is made by a particular use of a sentence depends on the context of utterance. In different contexts one and the same sentence can be used to make different statements – and it depends on the context whether the statement that ensues is true or false.

This, of course, typically holds for Russell's paradigm example featuring the indexical phrase 'the present king of France': Russell's example could have been true if uttered two centuries ago, but not when uttered in Russell's or Strawson's time, a fact Russell wholeheartedly agrees with.

According to this explication, Strawson anticipates the view of authors like Stalnaker (1970) and Kaplan (1989) who conceive of linguistic meaning as a function from contexts to propositions. Strawson's conception of statement then corresponds to what these authors call the 'proposition' expressed or the 'content' of what is said. It should be pointed out, however, that the notion of statement as an explication of the Kaplan/Stalnaker notion of content should be distinguished sharply from 'assertion', which is a notion of speech act theory. Now it is generally held that propositions are the contents of assertoric speech acts. Accordingly we may interpret Strawson as claiming that not sentences but statements qualify as the objects of assertoric speech acts. Interpreted this way the above version of Strawson's argument loses its force against the original Russellian analysis. Russell's central claim is not that we *assert* (in the sense of speech act theory) that there is a unique descriptum, his claim is a much more modest one: sentences containing descriptions are truthconditionally equivalent to the quantificational expansions from which the descriptions have been eliminated. Or, taking the character/content distinction into account and rephrased in the terminology of propositions or contents, his claim is that the content of an utterance made in a particular context is equivalent to the content of what would, in the same context (!), be expressed by the expansion from which the description is eliminated.³ Russell's theory as stated in Russell

³In his reply to Strawson, Russell (1959, p. 176) points out that by substituting 1905 for the indexical 'present' in the phrase 'the present king of France Strawson's argument technically collapses. See also Sellars (1954), Mates (1973) and Neale (1990) for further discussion that the question indexicality (or egocentricity as Russell would call it) is independent of the point Strawson wants to establish.

(1905, 1910) is fully independent of the speech act notion of assertion.⁴ Of course, in many contexts it may for various reasons be infelicitous or inappropriate to utter the natural language translation of the Russellian expansion. This, however, is independent of the issue of truthconditional content. Clearly, sentences may be true or false quite independently of their being ‘infelicitous’, ‘inappropriate’ or ‘confusing’. As far as the pragmatic line of attack goes Strawson’s argument mainly establishes that Russell’s account is incomplete as it stands, not that it is wrong.

As to the semantics the central issue is whether descriptions are to be analysed as referring expressions or names in the classic Fregean sense. A sentence containing a referring expression does neither for Frege nor for Russell express the proposition that there is some object that has a particular property. For such a sentence to have an interpretation it is required that the referring expression pick out some object and, only if it does, we may check for the relevant property whether it holds of this object. Frege moreover insists that the reference of a complex expression is a function of the references of its parts. It follows that, if one component lacks a reference, the whole expression will lack a reference. Coupled with his doctrine that the reference of a sentence is its truth value, it follows that no sentence in which a non-referring expression figures as a part can have a truth value.

This way the category of sentences which are not true is split up into two distinct subclasses: sentences which are false and sentences which are neither true or false. Now I won’t dispute that the claim that such a sentence does not have a truth value is defensible for the simple paradigm examples like ‘The king of France is wise’. But postulating this special class of non-true sentences by splitting up non-truth in falsity and lack of a truth value, is not a decision which can be made by observing that people are

⁴See Russell’s remarks on assertion and the assertion sign in *Principia Mathematica* (1910, p. 92), where Russell – following Frege – carefully distinguishes between asserting a proposition and putting it forward for mere consideration.

somehow reluctant in calling a sentence false if it is for some reason inappropriate or infelicitous to utter. Such a decision should be motivated on theoretical grounds, e.g. by showing that a phenomenon to be explained can be more adequately captured when we extend our semantic ontology this way. If not, calling sentence truthvalueless instead of false boils down to a mere terminological issue. Unfortunately, the claim that sentences with non-denoting grammatical subjects lack a truth value, does give rise to unpalatable consequences when we consider them as parts of extensional compounds. Reference failure is infectious. If one of the component sentences of a complex sentence lacks a value, any compound in which it figures as a part will lack a value as well. But now the Frege/Strawson position is in serious trouble. Obviously all of the following sentences have a determinate value even though they contain a component sentence that suffers from reference failure (and thus lacks a truth value).

- (11) a. France has a king and the king of France is bald.
 b. If France has a king, the king of France is bald.
 c. Either France does not have a king or the king of France is bald.

A straightforward application of the Frege/Strawson theory predicts that all these sentences will lack a truth value (and also wrongly predicts that they carry the presupposition that there is a king of France).⁵ However, for a Russellian (11a) through (11c)

⁵I hasten to add that this holds for a straightforward application of the Frege/Strawson ideas. Frege also considers a second strategy: restore definedness by assigning a null-object to all terms that suffer from reference failure. This unfortunately predicts that presuppositions never survive under embedding. I moreover add that, following Strawson, various authors have developed three-valued or other non-standard logics which enable us to block the presuppositional inferences in some embedded environments, while leaving them intact in others. However as the literature on presupposition projection has made abundantly clear, none of these strategies is able to cope with the full set of relevant data. See the discussions and overviews in Gazdar (1979), Van der Sandt (1988) and Beaver (2001)

raise no problems. Given the fact that there is no king of France (11a) is predicted to be false and (11b) and (11c) are predicted to be true.

There is a second, and equally serious, set of problems for the view that descriptions are referring expressions. As we saw, descriptions may be complex and encode any amount of descriptive information. And, most importantly, descriptions may contain free variables which can be bound by external quantifiers. We already saw an example in (3). (12a) and (12b) are two other examples.

- (12) a. Someone had a dog and his dog was frightened.
 b. If a man gets angry, his dog gets frightened.

In all these cases we encounter in the description a pronoun which depends on an external antecedent. Again, this is not a problem for the Russellian. In $\forall y [\text{girl}(y) \wedge \text{love}(y, x)]$, the Russellian encoding of the descriptive phrase in (3), we encounter a free variable which is bound by the universal quantifier. We observe the same phenomenon in (12a) and (12b). Here the pronoun *his* emerges as a variable which is free in the description and gets its value from the quantifiers in respectively the first conjunct in (12a) and the antecedent of the conditional in (12b). It is a problem for the Strawsonian, though. For in none of these cases there is an uniquely identifiable object on which the description depends and this precludes the possibility to analyse these phrases as referring expressions.

We have to conclude that Strawson's criticism of Russell is wanting and, as it stands, Russell's theory has a clear technical advantage. This does not alter the fact that the intuitions that gave rise to the Frege/Strawson view in the first place, are correct and should be accounted for in one way or another. For clearly, if a speaker utters a sentence like 'The present king of France is (not) bald' he will assume that there is such a person and assert (in the speech act sense of the word) that the person referred to is bald. Thus, if we don't limit ourselves merely to the truthconditional

analysis of the description language, but look at the functioning of descriptive phrases in a larger discourse we encounter the central drawback of Russell's analysis: it is incomplete as it stands. Consider the classic examples of Karttunen and Stalnaker:

- (13) a. The king of France is bald.
b. France has a king and the king of France is bald.
c. The king of France is bald and France has a king.

On a Russellian account (13a), (13b) and (13c) have the same truth conditions. They do have a different function in discourse though. (13a) will typically be uttered in a context or discourse which implicitly or explicitly contains an individual that satisfies the descriptive material. A felicitous utterance of (13b) requires a context which does not already contain such an individual, and (13c) is not admissible in any context. Note finally that the use of the full descriptive phrase in (13b) has an air of redundancy. It rather functions as a pronoun taking up the individual that has been introduced in the first conjunct. We observe the same phenomenon in a larger discourse. In the second sentence in (14a) the pronoun functions as a scantily dressed version of the full descriptive phrase, and it has, when interpreted in a context which contains a salient individual that is king of France, exactly the same interpretation as its non-pronominal counterpart:

- (14) a. France has a king ...
... *He* is bald.
b. France has a king ...
... *The king of France* is bald.

At face value the Russellian account and the Frege/Strawson view seem diametrically opposed. One might surmise (with Sellars (1954) and many others) that they may be reconciled by interpreting Russell's account as an account of truth-conditional content while simultaneously reinterpreting Strawson's basic intuition as pertaining to the 'pragmatics of communication'. However, the

fact that the descriptive phrases in (13b) and (14b) function in exactly the same way as the pronoun in (14a) suggests that this is not something that is easily achieved in a standard semantics. For, just like the pronoun in (14a), the descriptive phrase in (14b) is in a sense ‘contextually bound’ by an antecedent that has been introduced just before.

To account for the function of such sentences Russell’s theory has to be supplemented with an account of the dynamics of discourse. A proper account along these lines had to wait until the advent of discourse representation theory and other dynamic theories of interpretation. In the next section I won’t treat descriptions as denoting; I won’t treat them as referential expressions either. Instead I will treat them essentially as descriptively laden anaphors. It will then turn out that if we abandon the static classic view of meaning and adopt a dynamic and representational framework, Russell’s basic analysis of descriptions can be reinstated while simultaneously accounting for Frege’s and Strawson’s intuitions.

3. PRESUPPOSITIONAL DRT

Construction and resolution of Discourse Representation Structures

Discourse representation theory (DRT), as developed by Kamp (1981) and Kamp and Reyle (1993), belongs to a family of theories that focus on the interpretation of coherent stretches of discourse instead of sentences in isolation.

The basic idea is the following. Natural language utterances are interpreted sequentially and they are interpreted in a continually evolving discourse. In the course of this interpretation process the hearer constructs a representation of the discourse interpreted thus far and, while the discourse unfolds, he incorporates the information provided by each subsequent sentence in the already established representation structure. This respects the fact that the interpretation of sentence may depend on information

that is given in the context of utterance and the preceding discourse. Context dependence is particularly obvious when sentences contain anaphoric elements. Pronouns are a typical example, but anaphoricity is all pervasive. Quantifiers, modals and tenses are, just as pronouns, examples of linguistic elements which depend for their interpretation on a previously established universe. As to pronouns, we already saw that they may find their antecedent sentence internally as in e.g. (12), or in a previously established discourse as in (14a). And, when discussing (14b), we noted that substituting the descriptive phrase ‘the king of France’ for the pronoun does not alter the interpretation of this mini-discourse. Definite descriptions function in discourse as anaphoric expressions just as pronouns.⁶

The account given below will be formulated in a presuppositional extension of Discourse Representation Theory. I will limit myself to a rough outline and refer the reader for detailed expositions to the work of Kamp (1981) and Kamp & Reyle (1993), and for the presuppositional extension to Van der Sandt (1992) and Geurts (1999).

The central notion is that of a Discourse Representation Structure (DRS). DRS’s are representation structures consisting of a set of discourse markers and a set of conditions. Discourse markers are objects that are introduced while the discourse proceeds. Conditions come in various kinds. The simplest are the so-called atomic conditions. They encode the descriptive information that is assigned to discourse markers: discourse markers acquire and collect information in the course of a conversation.

Formally, a DRS K consists of an ordered pair $\langle U(K), Con(K) \rangle$, where $U(K)$, the universe of K , is a set of discourse referents and $Con(K)$ is a set of conditions. Processing the first sentence of (15) yields an example of such a representation structure:

⁶See in particular Heim (1982) and much work in the AI tradition.

- (15) a. France has a king.
 b. He is bald.

The representation for (15a) comes out as (16):

- (16) $[x \mid \text{kf}(x)]$

The indefinite NP *a king* introduces a discourse marker into the universe of the DRS, which will figure as the referent for this NP for the remainder of the discourse. The descriptive information is encoded in the condition $\text{kf}(x)$. The semantics of DRT tells us that this DRS is true in a model M if there is a function f such that it maps the discourse marker x onto entities in the domain of M in such a way that $f(x)$ has the property of being king of France. The semantics thus assigns exactly the same truthconditions to the DRS (16) as the standard semantics of predicate logic assigns to (17):

- (17) $\exists x \text{kf}(x)$

There is a crucial difference, though. Unlike predicate logic DRT does not represent the indefinite article by an existential quantifier but by a free variable, and this variable gets its existential import indirectly from the truth definition, which requires that *there be* a function that verifies the DRS in the model.

When processing (16b) we encounter another novelty. Pronouns (and other anaphoric expressions) come, in contrast to indefinites, with a special instruction: they should link up to a previously established discourse referent. This is indicated by encoding them as a special type of condition which is itself constructed out of a DRS consisting of the anaphoric variable and a possibly empty set of condition: $\partial [y \mid \dots]$. I will refer to such conditions as anaphoric conditions and to the argument of the ∂ -operator as a presuppositional frame (the rationale behind the latter locution will become clear later, when we treat definite descriptions – and

presupposition inducers in general – as anaphoric expressions). The encoding as a condition which introduces a DRS, may seem otiose for regular pronouns which lack syntactic structure and come with minimal descriptive content (they are marked at most for number and gender). But, as to representation of descriptions, I already pointed out that we need the full power of logical language. The syntactic complexity of non-pronominal anaphors is conveniently captured in a ∂ -condition. For, firstly, the anaphoric variable of a ∂ -condition may be embellished by any number of (atomic) conditions; secondly, ∂ -conditions may embed further anaphoric expressions, which will thus figure as conditions in their embedder; and, finally, such anaphoric conditions may contain variables that are free in this condition and thus may link up to an external antecedent. This allows for the encoding of presuppositional anaphors of any complexity.

But let me limit myself to pronouns for the moment. Adding both the anaphoric condition and the condition $\text{bald}(x)$ gives the following DRS for (15b):

$$(18) \quad \left[\begin{array}{l} \text{bald}(y), \\ \partial [y \mid] \end{array} \right]$$

We now merge (18) with the DRS for the incoming context, i.e. with (16), the DRS constructed for (15a). This merge is a simple operation which delivers a new DRS the universe of which consist of the union of the universes of the DRS's to be merged and similarly for its set of conditions.

$$(19) \quad [x \mid \text{kf}(x)] \oplus \left[\begin{array}{l} \text{bald}(y), \\ \partial [y \mid] \end{array} \right] = \left[x \mid \begin{array}{l} \text{kf}(x), \text{bald}(y), \\ \partial [y \mid] \end{array} \right]$$

It is important to see that the resulting DRS is a preliminary construct in the sense that the anaphoric elements (in the present case just $\partial [y \mid]$, the representation of the pronoun) are yet unresolved. Processing the anaphoric conditions is the task of the second module, the resolution algorithm. It links the anaphoric

variables in ∂ -conditions to their antecedents. In the present case this is simple. We resolve the anaphoric condition by equating the anaphoric variable y with x .

$$(20) \quad \left[x \mid \begin{array}{l} \text{kf}(x), \text{bald}(y), \\ \partial [y \mid] \end{array} \right] \rightsquigarrow \left[x, y \mid \begin{array}{l} \text{kf}(x), \text{bald}(y), \\ x = y \end{array} \right]$$

The result, which comes out in simplified form as $[x \mid \text{kf}(x), \text{bald}(x)]$ does not contain any anaphoric condition. It is a resolved DRS to which the standard truth definition of DRT applies. This DRS is true in a model M just in case there is an embedding of this structure into M such that $f(x)$ is in the domain of M and $f(x)$ has both the property of being king of France and of being bald. The output of the resolution process thus has the same truth conditions as the representation of the full discourse in predicate logic:

$$(21) \quad \exists x [\text{kf}(x) \wedge \text{bald}(x)]$$

But note that the standard (static) truth conditions only apply to the outcome of the resolution process: they capture the interpretation of the full discourse, not of isolated sentences. In this respect the notion of meaning is crucially different. DRT is a dynamic theory of meaning. The meaning of individual sentences is located in the change that results from interpreting a sentence in a discourse: it is a function from DRS's to DRS's; or, put differently, the meaning of a sentence is located in its context change potential.

In the version of DRT sketched above, processing of sentences in a discourse is essentially a two-step procedure, consisting of a construction and a resolution algorithm. In the first stage, the syntactic component builds preliminary DRS's and merges these constructs with the DRS that encodes the incoming context. Then there is the resolution algorithm. This mechanism takes care of the resolution of anaphoric expressions. In the resolution process we find the two major innovations of presuppositional DRT. It takes care of disambiguation in case an anaphoric expression has the

choice between different antecedents; and, as we will discuss in detail in the next section, it functions as a mechanism that determines the relative scope of definite descriptions and other presupposition inducers with respect to embedding operators. The resolution process is crucially guided by pragmatic principles, which are partially Gricean in nature, thus giving rise to an integrated theory of semantic and pragmatic interpretation.

DRS's need not be as simple as the example given. Logical connectives, operators and various types of quantifiers yield, just as ∂ -conditions, complex conditions, that is conditions which are themselves constructed out of DRS's. Thus, if K is a DRS, $\neg K$, $\Box K$, $\Diamond K$, $K_1 \vee K_2$, $K_1 \rightarrow K_2$ are complex conditions. When these conditions are part of a DRS, we perceive a hierarchical structure where DRS's are embedded in other DRS's. Complex conditions create subDRS's in the DRS that contains them. For example, the construction of the negated 'He is not bald' yields (22a). Processing proceeds as before. The provisional DRS for (22a) will be merged with incoming context, and the result of the merge will, by equating the anaphoric variable y with the already established marker x , resolve as in (22b):

$$\begin{aligned}
 (22) \quad & \text{a. } \left[\left| \neg \left[\left| \text{bald}(y), \right. \right. \right. \right. \\
 & \qquad \qquad \left. \left. \left. \left. \partial \left[y \mid \right] \right] \right] \right] \\
 & \text{b. } \left[x \left| \neg \left[\left| \text{bald}(y), \right. \right. \right. \right. \\
 & \qquad \qquad \left. \left. \left. \left. \text{kf}(x), \right. \right. \right. \right. \\
 & \qquad \qquad \left. \left. \left. \left. \partial \left[y \mid \right] \right] \right] \right] \rightsquigarrow \left[x \left| \neg \left[\left| \text{bald}(x) \right. \right] \right] \right]
 \end{aligned}$$

Binary connectives introduce two sub-DRS's, in the case of a conditional one for the antecedent and one for the consequent. The preliminary DRS constructed for (23a) thus comes out as (23b).

$$\begin{aligned}
 (23) \quad & \text{a. If France has a king, he is bald.} \\
 & \text{b. } \left[\left| \left[x \mid \text{kf}(x) \right] \rightarrow \left[\left| \text{bald}(y), \right. \right. \right. \right. \\
 & \qquad \qquad \left. \left. \left. \left. \partial \left[y \mid \right] \right] \right] \right] \\
 & \text{c. } \left[\left| \left[x \mid \text{kf}(x) \right] \rightarrow \left[\left| \text{bald}(x) \right. \right] \right] \right]
 \end{aligned}$$

The anaphoric variable will link up to the marker in the representation of the antecedent, thus resolving the full structure to (23c). The truth definition tells us that this DRS is true just in case every function f that verifies the antecedent can be extended to a function that also verifies the consequent. Again, this yields the same truth conditions as would be assigned to (24) on their standard translation into predicate logic:

$$(24) \quad \forall x[\mathbf{kf}(x) \rightarrow \mathbf{bald}(x)]$$

The last example illustrates another, central, feature of DRT. Whether or not ‘donkey anaphora’ is involved, indefinites are always represented in the same way: they introduce a discourse referent in the DRS where they syntactically originate. However, if indefinites bind pronouns or other anaphors in the consequent of a conditional, they acquire universal quantificational force; and this happens as a result of the truth definition, which requires that *every* embedding that verifies the antecedent can be extended to a verifying embedding of the consequent. As in the case of sequences of sentences we are able to semantically extend the scope of discourse referents to positions that cannot be accessed in standard static theories.

Quantifiers like ‘every’, ‘no’, and ‘most’ create so-called duplex conditions. Duplex conditions mimic generalised quantifiers. A duplex condition consists of three parts: the quantifier Q with the variable quantified over and two DRS’s. The leftmost DRS is called the restrictor, the DRS on the right of the quantifier its nuclear scope. The preliminary DRS for (25) comes out as (26).

(25) Most countries which have a queen, honour her.

$$(26) \quad \left[\left[\left[x, y \mid \begin{array}{l} \mathbf{country}(x), \mathbf{queen}(y), \\ \mathbf{poss}(x, y) \end{array} \right] \langle \mathbf{MOST} \rangle_x \left[\left[\mathbf{honour}(x, z), \right] \right] \right] \right]$$

The anaphoric variable z links up to y yielding

$$(27) \quad \left[\left[\left[x, y \mid \begin{array}{l} \text{country}(x), \text{queen}(y), \\ \text{poss}(x, y) \end{array} \right] \langle \text{MOST} \rangle_x \left[\mid \text{honour}(x, y) \right] \right] \right]$$

The truth conditions are as expected: for most x which satisfy the conditions on the left it holds that they satisfy the conditions on the right. Note that only the x is quantified. The quantificational force of the indefinite remains unaffected.

This leaves me with the notions of subordination and accessibility. Subordination is a configurational notion. Embedding a DRS in another DRS gives rise to subordination of the former to the latter. Thus in (22a) the negated structure is subordinate to the main DRS, in (23b) both the antecedent and the consequent structure are subordinate to the main DRS, and the same holds in (26) for the restrictor and the nuclear scope of the duplex condition. Subordination constrains which discourse referents qualify as antecedents of the anaphoric elements as encoded in the ∂ -conditions. It is the basis for the definition of accessibility. A discourse referent is accessible to a variable in a ∂ -condition in two cases. Firstly, if it is in the universe of a superordinate structure; and, secondly, anaphoric variables in the consequent of a conditional can access discourse referents in the universe of its antecedent. The same holds for duplex conditions: the anaphoric variables in the nuclear scope of a duplex condition have access to discourse referents in the universe of the restrictor. Since accessibility is a transitive relation this creates an accessibility path for the anaphoric variables in ∂ -conditions. They may look upward through discourse structures, they may moreover look from the consequent of a conditional into its antecedent (and similarly, with duplex conditions, from the scope into the restrictor), but they cannot look downwards. In the following diagram the accessibility path for discourse referent x_4 is 3–2–1 and the accessibility path for x_6 is 5–2–1.

$$(28) \quad \left[x_1 \mid \left[x_2 \mid \neg \left[x_3 \mid \partial \left[x_4 \mid \right] \right] \right] \right] \langle Q_{x_2} \rangle \left[x_5 \mid \partial \left[x_6 \mid \right] \right]$$

Thus x_4 has access to x_1, x_2 and x_3 , and x_6 has access to x_1, x_2 and x_5 . However, x_4 cannot access x_5 (we cannot look from the restrictor into the nuclear scope) nor can x_6 access x_3 (since it is in a DRS that is subordinated to DRS_2 and thus not on its accessibility path). This correctly predicts that the pronoun in the second sentence of (29a) may link up to the discourse referent created for the indefinite in the first sentence, but that no anaphoric connection can be made in (29b).

- (29) a. France has a king. He is not bald.
 b. France does not have a king. He is bald.

In the latter case the discourse referent for the pronoun is introduced at a subordinate level and thus not accessible. In this case the resolution algorithm will thus come to a halt, no resolved DRS will come about and the discourse will consequently lack an interpretation.

Binding and accommodation of presuppositional expressions

According to the standard theories of presupposition, presuppositional information is information that is taken for granted by the participants in a discourse or a conversation. As such it has a different status from the information the participants intend to present as new or relevant. For example, by his use (30) a speaker typically indicates that he takes for granted that the Netherlands has a queen, and by the same sentence he conveys that she wears a wig.

- (30) The queen of the Netherlands wears a wig.

Thus characterised the distinction between non-presuppositional and presuppositional information is a distinction in function. However, this distinction in function is linguistically realised in the linguistic structure of sentences. In the above case the information that the Netherlands has a queen, is invoked by the definite phrase ‘the queen of the Netherlands’. The presupposition that the Netherlands has a queen, is said to be induced by the use of the definite article – or, put otherwise, the definite article is a presupposition trigger.

This way of introducing the notion of presupposition shows that the notion of presupposition as used in the literature is an ambiguous one. We thus have to make some distinctions, and the basic distinction that should be made is the distinction between presupposition as information taken for granted and presupposition as induced, invoked or triggered by a linguistic expression. The first notion is the notion of presupposition as background information, that is information which is already given or taken for granted in a conversation. Stalnaker (1975) and Karttunen (1974) call it the common ground. The second notion is the notion of presupposition as information that is conventionally associated with linguistic expressions or syntactic constructions. Though the two notions of presupposition are fundamentally different, there is a straightforward connection. If a linguistic element induces a presupposition, the sentence containing the inducing element will typically be appropriate in a context which already contains the presuppositional information. Thus (30) will normally be judged appropriate or acceptable in a context in which the information that the Netherlands has a queen is somehow established or taken for granted. If not, one should rather convey this information in a less compact way e.g. as in (31).

(31) The Netherlands has a queen and she wears a wig.

When saying that a sentence which contains a presupposition inducer and thus invokes presuppositional information is

typically be appropriate in a context which already contains this information, I carefully added the word ‘typically’. Preservation of presuppositionally induced information is indeed the default but, as the literature on presupposition projection amply testifies, there are many exceptions. Thus in the following conditional, the consequent invokes the presuppositional information that there is a king of France, but the whole sentence makes no suggestion whatsoever as to the existence of such an individual.

(32) If France has a king, the king of France is bald.

Nor does (33).

(33) It is possible that France has a king and that the king of France is bald.

In the above two cases the information that France has a king, is introduced – in a non-presuppositional way – in respectively the antecedent of the conditional and the first conjunct of the modalized sentence. Intuitively, the presuppositional expressions link up to the information thus introduced: they turn out to have the same function as pronouns. Pronominalizing the descriptions in (32) and (33) yields more idiomatic rephrasings in which the pronouns are bound to the indefinite that serves as their antecedent. The phenomenon that descriptive phrases can be bound by antecedently given antecedents is not limited to descriptive phrases but turns out to be quite general. If we find a presuppositional expression that depends on some previously introduced entity there is normally a more idiomatic counterpart that features anaphoric expressions that are more scantily dressed. The following illustrates this for two other types of presupposition inducers: factive verbs and verbs of transition.

- (34) a. If the king of France is bald, his wife will regret *that/that he is bald*.
 b. If John used to smoke, he stopped *doing so/smoking*.

Just as in (32) and (33) the relevant information is introduced at a subordinate (but accessible) level of discourse structure, and the presuppositional information links up to this information, just as pronouns do.

The explanation I proposed in earlier work (van der Sandt 1992) is simple. Presupposition inducers are regular anaphoric expressions on a par with pronouns and other descriptively impoverished anaphors. This comprises simple and composite descriptions like ‘the king of France’, ‘the boy who kissed all girls’ and ‘the nanny of my neighbour’s dog’; it also comprises cleft constructions, verbs of transition (*begin*, *stop*, *continue*), adverbs like *too* and *again*, factive verbs (*regret*, *be surprised*, *discover*) and many others. All these expressions induce information that has to be resolved in context. More specifically, they search for an accessible antecedent. This antecedent may be given at the main level (which is always accessible) or at some subordinate accessible position. In the cases just given they find their antecedents at a subordinate level where they resolve just like regular pronouns.

In the examples (32) and (33) the accessible context contains an explicit antecedent. The question arises what happens if this is not the case, e.g. when we utter (30) out of the blue. One might think that if (30) were uttered in a context in which the presuppositional information is not already established, the resolution algorithm would stop and the discourse would come to a halt. This is not what we observe, however. As Lewis pointed out ‘it is not as easy as you might think to say something that will be unacceptable for lack of required presuppositions. Say something that will be unacceptable for lack of a required presupposition, and straight away that presupposition springs into existence, making what you said acceptable after all’ (Lewis 1979, p. 339). This phenomenon is known as accommodation.

If at time t something is said that requires presupposition P to be acceptable, and if P is not presupposed just before t , then—*ceteris paribus* and within certain limits—presupposition P comes into existence at t . (Lewis 1979, p. 340)

This brings me to the main difference between presuppositional expressions and pronouns. In case a pronoun cannot find an antecedent, the sentence will not get an interpretation for the simple reason that the resolution algorithm does not come to an end. However, sentences containing presupposition inducers will, under the same condition, normally get a determinate value. The reason is simple. Presuppositional expressions differ from pronouns and other impoverished anaphors in that they carry a certain amount of descriptive information. Thus, while the presuppositional frame of a pronoun is simply $[x \mid]$ ⁷, the information invoked by regular presupposition inducers carries additional constraints. For example, the presuppositional frame for ‘the queen of the Netherlands’ comes with an extra condition $[x \mid \text{queen_of_the_netherlands}(x)]$.⁸

Thus, if the incoming discourse lacks an accessible antecedent, the descriptive content associated with the presuppositional expression will allow a cooperative recipient to establish a discourse marker and attach the associated constraints to it; the resulting entity may then function as an antecedent for the presuppositional anaphor. This process also captures our intuition that (35a) is presupposing: the sentence *requires* the presuppositional information for its interpretation. For (35b) there is no such requirement. The first sentence introduces, explicitly and non-presuppositionally, the information that France has a king and thus provides an antecedent – just as happens in the discourse (35c).

- (35) a. The king of France is bald.
 b. France has a king and the *king of France/he* is bald.
 c. France has a king. *The king of France/he* is bald.

⁷Or, at most, an embellishment with number and gender.

⁸Or, at a deeper level of analysis: $\partial \left[x \mid \begin{array}{l} \text{queen}(x), \text{of}(x, y) \\ \partial [y \mid \text{the_netherlands}(y)] \end{array} \right]$. Note the embedding of a presuppositional condition in another presuppositional condition.

The resolution of (36), the provisional DRS for (35a) illustrates the accommodation mechanism.

$$(36) \quad \left[\left[\begin{array}{c} \text{bald}(x) \\ \partial [x \mid \text{kf}(x)] \end{array} \right] \right]$$

This structure resolves to (37):

$$(37) \quad [x \mid \text{kf}(x), \text{bald}(x)]$$

Note that the universe of the provisional DRS (37) is empty – just as in the case of (18), the provisional DRS for its pronominalized counterpart. But (36) differs from (18) in that the anaphoric condition does not just consist of a bare variable, but comes with the information that this variable should satisfy the condition $\text{kf}(x)$. The discourse referent comes about by accommodation and during this process the associated conditions are transferred to the level where the discourse referent is entered in the DRS, thus establishing a proper antecedent for future anaphors to bind to. Note, moreover, that the DRS so obtained is identical to the DRS that would result from processing (35b) or the discourse (35c). The output is the same, but the presuppositional (35a) which is intuitively presupposing, differs from the other examples that this sentence requires for its interpretation the information that there is a king of France, whereas in the non-presupposing variants no accommodation is called for since the relevant information is explicitly given. The current account thus simultaneously captures the Russellian claim that all these sentences are truthconditionally equivalent and the Frege/Strawson intuition that an utterance of (37a) presupposes that there is a king of France.

In the last example accommodation just saved interpretability by establishing a discourse marker for the anaphor to bind to. To illustrate that resolution by accommodation is a very powerful device if applied to presuppositional expressions in embedded

environments, I conclude this section by illustrating the mechanism with respect to the negation of (35a). The provisional DRS is (38):

$$(38) \quad \left[\left| \neg \left[\left| \text{bald}(x) \right. \right. \right. \right. \\ \left. \left. \left. \partial [x \mid \text{kf}(x)] \right] \right] \right]$$

The negation operator creates a subDRS, which contains the presuppositional anaphor. This anaphor will search along its accessibility path for an antecedent to bind to, but just as in (36) it will not find one. The discourse thus has to be saved by accommodation. The first option is the main context. Entering the discourse marker with the presuppositional constraint at top level gives (39):

$$(39) \quad [x \mid \text{kf}(x), \neg [\mid \text{bald}(x)]]$$

The description has primary occurrence to put it in the Russellian way. In present day discourse this reading will be blocked however, since it is in conflict with background knowledge. But, given the fact that the description is at a subordinate level, there is a second option: accommodation in the—equally accessible—subordinate structure i.e. within the scope of the negation operator. This yields the structure where the description has secondary occurrence:

$$(40) \quad [\mid \neg [x \mid \text{kf}(x), \text{bald}(x)]]$$

In short, the resolution mechanism produces the two readings Russell gets—in a purely syntactic way—by the interaction of quantifiers and operators. But in the current framework we get an additional prediction: on the reading where we accommodate the descriptive phrase in the main context, the sentence is predicted to presuppose that France has a king, just as Frege and Strawson would have it.

Let us take stock. Presuppositional expressions are anaphoric expressions on a par with pronouns and other attenuated anaphors

and thus need to be resolved in context. This can happen in either of two ways. Firstly, the anaphoric variable of a presuppositional frame may be equated with some discourse marker that it can reach along its accessibility path. If it links up to such a marker (which will thereby serve as its antecedent), the associated conditions will be attached to the binding site and the antecedent will so inherit all descriptive material the presuppositional expression carries. If no such antecedent can be found, the presuppositional information will (normally) be accommodated at some accessible level, thus creating an accessible antecedent after all.⁹

4. PRESUPPOSITION RESOLUTION VERSUS RUSSELLIAN SCOPE

In an influential paper Keith Donnellan (1966) drew a distinction between the so-called attributive and referential use of descriptions, and argued that Russell's theory does not adequately capture the referential use as exemplified by my pointing in a trial to Jones, the murderer of Smith, and saying 'Smith's murderer is insane'. In such a case, Donnellan argued, the description is used referentially and functions as a name. We don't assert that *there is* one and only one person who murdered Smith and is insane. Instead we say *of* this particular individual, Jones in the present case, that he is insane. Donnellan contrasted this with the attributive use as we find when this sentence is uttered by a detective who finds Smith's heavily mutilated body and has not yet a clue as to who killed him. Here Russell's analysis seems to give the right result: we convey that there is some (unique) individual who murdered Smith and is insane. A major drawback of this view is that it makes descriptions semantically ambiguous. I will not go into the extensive literature on this issue but remark that the current account when supplemented with a Kripkean view on

⁹'Normally', since the process of accommodation is constrained by various factors which comprise consistency and various constraints of a Gricean nature. See Van der Sandt (1992) for a detailed account.

proper names or the Kaplanian account of indexicality, captures the Donnellan's distinction rather well. In the referential case the description 'Smith's murderer' links up to the (indexically embellished) proper name 'John' and thus gets (albeit indirectly) a referential interpretation. In the attributive case no such link is made. The descriptive information is accommodated.

Following Donnellan it has been suggested that his distinction can be used to account for the *de re/de dicto* distinction, which is traditionally accounted for by Russellian scope. I will not go into this issue here, but just remark with Kripke (1979) that no binary distinction can replace the Russellian notion of scope. When operators are iterated, Russell's account predicts intermediate readings. And, of course, it should – as Kripke's (41) shows:

(41) The number of planets might have been necessarily even.

Russell's account gives three possible readings. The description may outscope both modal operators. This yields a reading according to which the sentence is false. Narrow scope of the description also gives a false reading. The true reading (42) shows intermediate scope and yields truth:¹⁰

(42) a. $\diamond [\neg x.\text{number_planets}(x)] \square \text{even } \neg x.\text{number_planets}(x)$
 b. $\diamond \exists!x [\text{number_planets}(x) \wedge \square \text{even}(x)]$

At the end of the previous section I pointed out that the account of presupposition which views presuppositions as regular

¹⁰This paper was written in the (northern hemisphere) summer of 2006 at sunny Brazilian beaches. After my return to the Netherlands I found out that Pluto had been demoted to a dwarf. I nevertheless decided stick to a venerable cultural and philosophical tradition and I thus assume, for the purposes of this paper, that the number of planets is 9. Astrophysicists who find this offensive, are invited go with the definition of the International Astronomic Union and to change in this example and in the following paragraphs all occurrences of 'even' to 'uneven'. This does not affect the argument.

anaphors, gives us Russellian scope as a bonus.¹¹ It encodes the descriptive phrase as a standard presupposition inducer,

$$(43) \quad \partial [x \mid \text{number_planets}(x)]$$

which yields (44) as the pre-structure for (41):

$$(44) \quad \left[\left[\diamond \left[\left[\square \left[\left[\partial [x \mid \text{number_planets}(x)] \right] \right] \right] \right] \right] \right]$$

The anaphoric expression will look upwards along its accessibility path and search for an antecedent to bind to. Since no such antecedent will be found, the presuppositional information has to be accommodated. The accommodation mechanism gives us – in principle – the option of projecting the presuppositional structure to any of the three Russellian positions (all of which are accessible). The first option is accommodation at the top level of discourse structure (the main context). This yields the reading according to which the description has scope over both embedding operators.

¹¹To prevent possible misunderstandings I want to stress that the resolution mechanism regulates the relative scope of presuppositionally induced information with respect to embedding operators. In the case of definite descriptions (and other presuppositional expressions which can be analysed the same way) this information is that there is an object that satisfies the descriptive conditions. The outcome of the resolution process captures what Russell achieves by syntactically generating scope in the description language. This is because every type of presupposition is scope-taking in the following sense: it may – by its capacity to accommodate at different levels of discourse structure – in its final representation represent the presuppositional information within or outside the scope of embedding operators. Of course, this does not capture regular quantifier scope as are found in e.g. ‘Every boy kissed a girl’, where the indefinite phrase may outscope the universal quantifier (though the existential import of the universal quantifier, i.e. the presuppositional information that there is a (contextually given) set of boys will be scope taking in the sense explained). Here I will be totally agnostic as to the issue whether the traditional notion of quantifiers scope should be regulated in syntax, by the Montagovian technique of ‘quantifying in’, by some mechanism of underspecification or in yet another way. See Geurts (1999) for a discussion of the distinction between scope by projection and classic quantifier scope.

$$(45) \quad [x \mid \text{number_planets}(x), \diamond [\mid \square [\mid \text{even}(x)]]]$$

But since background knowledge tells us that this reading is false it will be blocked. Background knowledge will also block both the narrow scope reading of the description. This leaves us with intermediate scope. Put more succinctly, the syntactic base generates (44) and the resolution algorithm maps it to (46):

$$(46) \quad [\mid \diamond [x \mid \text{number_planets}(x), \square [\mid \text{even}(x)]]]$$

Though non-controversial examples which show intermediate scope are ubiquitous (iteration of attitude verbs, modal operators, logical connectives and various mixtures), there has been some opposition to the idea of intermediate accommodation.¹² Accommodation – so the alternative story goes – is not a structural operation at the level of logical form, it is a global process which takes place at a metalevel. It is an operation which, in the face of threatening infelicity, forces a co-operative recipient to revise his view on the incoming context and thus modifies the *global* incoming context by inserting the missing material in order to guarantee felicity after all. This view has a number of serious drawbacks, however. The first problem is technical. It turns out to be very difficult to explain this view in non-metaphorical terms.¹³ Then there is a methodological problem. Rejection of intermediate (and local) accommodation forces the analyst to supplement his (global) accommodation mechanism with additional Russellian scope mechanism to account for cases which could be handled by the projection mechanism straight away. Ockham certainly would object.

There is a third problem, though. On the account of presupposition I just sketched, presuppositional binding and accommodation are two sides of the same coin. Presuppositional expressions can be bound by a suitable antecedent provided that they occur in an accessible position. And, going in the other direction, they may accommodate an antecedent in any position from where this

¹²E.g. Von Stechow (1994) and Beaver (2001),

¹³But see Beaver's account in terms of information sets (2001, Ch. 9.3).

antecedent can access and thus bind the presuppositional anaphor. Since this account is implemented in a dynamic theory of meaning it gives an extra option. As I pointed out in the previous section, dynamic theories allow for semantic binding from the antecedent of a conditional into its consequent, and from the restrictor of a quantifier into its nuclear scope. This gives an additional accommodation possibility, the restrictor of a quantifier (or the antecedent of a conditional), an option which was not yet available on Russell's account.

Examples of restrictor accommodation abound. Quine noted as early as 1941 that (47) is to not be construed as meaning that Tai is always eating and using chopsticks when doing so. It is more likely to mean that whenever Tai eats he does so with chopsticks.

(47) Tai always eats with chopsticks.

As Quine puts it: the unwanted representation suggests gluttony, the proper representation daintiness (Quine 1941, p. 91).

Many more examples are found in the literature on generics, focus and presupposition projection. Presuppositional – and backgrounded information in general – tends to be interpreted in the restrictor of quantified structures as Schubert and Pelletier's work on generics (Schubert and Pelletier 1989) amply testifies. In (48a) the relevant cats quantified over are cats that are somehow in the air; the proper interpretation of (48b) does not pertain to the majority of Californians but only to the voting ones; and (48c), finally, suggests in no way that each visitor carries a cell phone but only applies to visitors who carry one.

- (48)
- a. Cats always land on their feet.
 - b. Most Californians voted for Schwarzenegger.
 - c. All visitors should leave their cell phone with the security officers.

Since (48a) and (48b) involve some additional complications involving tense and focus, I illustrate the mechanism with respect to (48c).¹⁴ The syntactic base generates (49):

$$(49) \quad \left[\left[\left[x \mid \text{visitor}(x) \right] \langle \forall_x \rangle \left[\left[\partial \left[y \mid \begin{array}{l} \text{leave}(x, y) \\ \text{phone}(y) \\ \text{poss}(z, y) \\ \partial [z \mid] \end{array} \right] \right] \right] \right] \right]$$

Note that the presuppositional frame for the descriptive phrase embeds the representation of the pronoun. The full structure resolves in two phases. Resolution starts with the most deeply embedded anaphoric expression, i.e. $\partial [z \mid]$, equates z with the quantified referent x in the restrictor, thus yielding:

$$(50) \quad \left[\left[\left[x \mid \text{visitor}(x) \right] \langle \forall_x \rangle \left[\left[\partial \left[y \mid \begin{array}{l} \text{leave}(x, y) \\ \text{phone}(y) \\ \text{poss}(x, y) \end{array} \right] \right] \right] \right] \right]$$

The pronoun is thus bound, but the anaphoric variable of its embedder will not find a proper antecedent and thus has to be accommodated. The general rule is that accommodation takes place as high as possible, i.e. preferably in the main DRS. In the present case this possibility is blocked since x is entered in the restrictor and accommodating $\text{poss}(x, y)$ at top level would leave x free in this condition.¹⁵ We thus accommodate one level lower along its accessibility path, entering the information in the restrictor. This gives (51) as output:

$$(51) \quad \left[\left[\left[x, y \mid \begin{array}{l} \text{visitor}(x), \\ \text{phone}(y), \text{poss}(x, y) \end{array} \right] \langle \forall_x \rangle \left[\mid \text{leave}(x, y) \right] \right] \right]$$

¹⁴For an account of the focus/background distinction in the present frameworks see Geurts and Van der Sandt (2004).

¹⁵The phenomenon is known as trapping. See Van der Sandt (1992) for details.

In the last example I illustrated the presuppositional mechanism with respect to a dependent possessive phrase—a species of open descriptive phrases. But, as I said before, the mechanism is generally applicable to any kind of anaphoric expression. So let me conclude with a perhaps unexpected example—tense. In (52) the temporal information, which is syntactically induced in the nuclear scope of the quantificational adverb, ends up in the restrictor.

(52) Floppy was always on the run.

Again, this is readily explained if we adopt Partee's (1973) suggestion that verb tenses should be treated as a kind of pronoun. In the present framework this comes down to encoding the tense morpheme as a presuppositional expression consisting of an anaphoric variable and an associated temporal constraint. Assuming that the main DRS contains an indexical constant n for the moment of utterance, the future tense is represented as follows:

(53) $\partial[t \mid t < n]$

The syntax thus generates (54b) for (54a):

(54) a. Floppy was on the run.
 b. $\left[\begin{array}{l} \text{flop_run}(t), \\ \partial[t \mid t < n] \end{array} \right]$

Combining this with $[t \mid] \langle \forall_t \rangle [\mid]$, the frame for the presuppositional adverb yields (55) as the pre-structure for (53):

(55) $\left[n \mid [t \mid] \langle \forall_t \rangle \left[\begin{array}{l} \text{flop_run}(t'), \\ \partial[t' \mid t' < n] \end{array} \right] \right]$

Note that the temporal information is encoded in the place where it syntactically originates. However, in the course of the resolution process the temporal information percolates upwards along its accessibility path. But, after being bound by the quantified variable, it is intercepted in the restrictor resulting in (56):

$$(56) \quad \left[n \mid [t \mid t < n] \langle \overset{\vee}{t} \rangle [\mid \text{flop_run}(t)] \right]$$

This keeps syntax as simple as possible. For just like other presuppositional information temporal information is generated *in situ*, i.e. the place where we syntactically find it (normally the morphology of the verb). The phenomenon that verb tenses tend to link up to contextually given temporal locations and the tendency to take wide scope in case no prior temporal information is given, are accounted for by its anaphoric nature.

The data thus require projection of presuppositional material to various non-global levels. The data are moreover easily and most economically accounted for when we adopt the principle that presuppositional material tends to flow upwards – generally as high as constraints on binding and accommodation allow. On this account definite phrases behave just like any other species of the multifarious family of presupposition inducers.

One final point should be made. The reader will have noticed that, when encoding descriptive phrases, I left out the uniqueness condition. Let me first remark that an orthodox Russellian has no choice. In Russell's original framework the only difference between indefinites and definites is that the latter come with an additional uniqueness condition. Thus, when the uniqueness requirement were left out, the distinction between definites and indefinites would collapse. When we look at the functioning of descriptive phrases in actual discourse the uniqueness assumption is highly problematic, however. More often than not a descriptive phrase succeeds in singling out a unique individual even if the descriptive material actually satisfies many other individuals. This happens in particular when the descriptive phrase carries only a small amount of semantic information.

(57) Yesterday Mary saw a man and a woman. The man was wearing a red shirt.

This mini-discourse is clearly felicitous in a setting in which there are many other male individuals around besides the one mentioned in the first sentence of (0). An orthodox Russellian is thus forced to take the descriptive phrase as somehow elliptical for ‘the man Mary saw yesterday’ or, if Mary met yesterday – not implausibly – other men as well, as elliptical for ‘the man Mary saw yesterday and who . . .’ On the current account it would, technically, be no problem to add a uniqueness requirement to the presuppositional frame of a descriptive phrase. But, as the example just given illustrates, such an addition would, observationally, be most unwelcome. Moreover, since on the current account descriptive phrases function as embellished pronouns there is no need to do so. The resolution mechanism will link anaphoric variable of the description to the discourse referent established for the man mentioned in the first sentence and thus single out the intended individual.

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