
The problems posed by donkey anaphora for semantics have been recognized for a long time. In its simplest form, the problem is how to explain the anaphoric connection felt to exist between certain pronouns and indefinite expressions in cases like (1) in which the indefinite does not c-command and hence cannot directly bind the pronoun.

(1) Every man who bought a donkey vaccinated it.

Neale (1990) proposes to solve this problem by analyzing anaphoric pronouns in such examples as definite descriptions whose content is recovered from an antecedent clause by the following rule (numbering is as in Neale):

(P5) If \( x \) is a pronoun that is anaphoric on, but not c-commanded by, a quantifier \( \left[ D_x: F_x \right] \) that occurs in an antecedent clause \( \left[ D_x: F_x \right] (G_x) \), then \( x \) is interpreted as the most "impoverished" definite description directly recoverable from the antecedent clause that denotes everything that is both \( F \) and \( G \).

This analysis has two sub-instances depending on whether or not the quantifier that the pronoun is anaphoric on is maximal.

(P5a) If \( x \) is a pronoun that is anaphoric on, but not c-commanded by a non-maximal quantifier \( \left[ D_x: F_x \right] \) that occurs in an antecedent clause \( \left[ D_x: F_x \right] (G_x) \), then \( x \) is interpreted as \( \left[ \text{the } x: F_x & G_x \right] \).

(P5b) If \( x \) is a pronoun that is anaphoric on, but not c-commanded by a maximal quantifier \( \left[ D_x: F_x \right] \) that occurs in an antecedent clause \( \left[ D_x: F_x \right] (G_x) \), then \( x \) is interpreted as \( \left[ \text{the } x: F_x \right] \).

Maximality is defined as follows:

(P3) A quantifier \( \left[ D_x: F_x \right] \) is maximal if and only if \( \left[ D_x: F_x \right] (G_x) \) entails \( \left[ \text{every } x: F_x \right] \), for arbitrary \( G \).

The simplest form of this proposal faces difficulties with (1). If we take the occurrence of the in the expression \( \left[ \text{the } x: F_x & G_x \right] \) in (P5a) to be an occurrence of the overt lexical definite description the, it in (1) goes proxy for the definite description \( \left[ \text{the } y: \text{donkey(}y\text{)} & x \text{ bought } y \right] \), which for Neale is scoped to give the following semantic representation.

(2) \[ \text{Every } x: \text{man (}x\text{)} \& \left[ \text{some } y: \text{donkey (}y\text{)} \right] \left( x \text{ bought } y \right) \]
\[ \left[ \text{the } y: \text{donkey (}y\text{)} \& x \text{ bought } y \right] \left( x \text{ vaccinated } y \right) \]

On the assumption that singular definite descriptions presuppose that there is a unique (salient) object answering to the content of the description,\(^1\) the definite description \( \left[ \text{the } y: \right] \)

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\(^1\) For purposes of exposition, I assume here without argument that the badness associated with singular definite descriptions used in situations in which there is not a unique object answering to the content of the description derives from presupposition failure. None of the arguments of the present paper depend on this assumption.
donkey(y) & x bought y] presupposes for each value of x that there is exactly one donkey that 
x bought. If associated with the representation in (2), (1) is thus predicted to give rise to this 
presupposition. However, (1) gives rise to no such presupposition.

This version of Neale's proposal faces further difficulties when we consider the 
sentence in (3).

(3) Every man who bought a donkey vaccinated the donkey he bought

In contrast to (1), the sentence in (3) does presuppose that every man who bought a donkey 
bought exactly one, and hence cannot be felicitously used in a situation in which some man is 
known to have bought more than one donkey. Furthermore, the most plausible LF 
representation for the sentence in (3) is that given in (2). If (2) is simultaneously the 
semantic representation of (1) and of (3), then we predict that these two examples should 
have the same presuppositions. Patently, however, they do not.

Neale is of course aware of the above problem. He proposes to get around it by 
analyzing the definite description that goes proxy for a pronoun as a numberless description, 
which he represents in the general case as [whe x: Fx & Gx]. In the case of (1), the 
description recovered is interpreted to mean the same as the definite description the donkey 
or donkeys that x bought. This makes it possible for Neale to maintain (2) as a 
representation for (3) while positing a separate representation for (1) given in (4).

(4) [Every x: man (x) & [some y: donkey (y)] (x bought y)] 
   (whe y: donkey (y) & x bought y] (x vaccinated y))

With this as its LF representation, sentence (1) will not presuppose that each farmer who 
bought a donkey bought exactly one. This idea of treating the pronoun in donkey anaphora 
examples as semantically numberless appears in other places in the literature as well, 
including Francez & Lappin (1994?) and Krifka (1997?). In this squib I will argue that such 
a proposal is misdirected and untenable.

2. Against Pronouns as Numberless Definite Descriptions

The central observation that tells against this proposal is the observation that donkey 
anaphoric pronouns can be replaced by incomplete definite descriptions without altering the 
truth conditions or the assertability conditions of the sentence. Thus, (5) is exactly parallel 
to (1) both in the range of anaphoric relations that can obtain for the definite description the 
donkey and in the lack of uniqueness presuppositions associated with this expression.

(5) Every man who bought a donkey vaccinated the donkey

The pattern illustrated by the three sentences in (1), (3) and (5) appears to be fully general -- 
whatever properties appear on a donkey anaphoric pronoun accrue as well to a donkey 
anaphoric incomplete definite description, though not necessarily to a corresponding 
complete definite description. This is illustrated below for a handful of examples which 
have become standards in the literature.

(6) a. Everyone who bought a sage plant bought five other sage plants together with it 
b. Everyone who bought a sage plant bought five other sage plants together with the 
sage plant 
c. Everyone who bought a sage plant bought five other sage plants together with the 
sage plant that he bought

(7) a. No parents who have a teenage son lend him the car on weekends 
b. No parents who have a teenage son lend the teenage son the car on weekends 
c. No parents who have a teenage son lend the teenage son that they have the car on 
weekends
(8)  a. Most men who own a donkey beat it  
    b. Most men who own a donkey beat the donkey  
    c. Most men who own a donkey beat the donkey that they own  

In (6), neither the (a) nor the (b) sentences give rise to a uniqueness presupposition like that found in (3).  (6c), in contrast, is initially felt to have such a uniqueness presupposition and hence to be contradictory.\(^2\) In (7), the (a) and (b) sentences are appropriate even in contexts in which some parents are taken to have more than one teenage son.  (7c), however, presupposes that parents with a teenage son have exactly one, and so is inappropriate in these same contexts.  Finally, intuitions for the sentences in (8a,b) are hard to pin down in situations in which some men own more than one donkey, though the going opinion seems to be that in such situations the men who own more than one donkey have to beat most of their donkeys in order for the sentence to come out true.  (8c), in contrast, is simply inappropriate in such contexts, the anaphoric definite description carrying a uniqueness presupposition absent in (8a,b).

If we adopt a Neale style analysis for the (a) examples in (6) - (8), the obvious question that arises is how to differentiate the (b) examples from the (c) examples.  Analyzing the overt definite determiner the as numberless would account for the absence of uniqueness presuppositions in the (b) examples, though at an unacceptably high cost.  If the same determiner is assumed to occur in the (c) examples, such an analysis would make it impossible to account for the presence of uniqueness presuppositions in these latter examples.  Analyzing the definite determiner of an incomplete description as semantically numberless and that of a complete description as number sensitive fares no better.  Such an analysis would make it impossible to account for the uniqueness presuppositions triggered by the occurrences of the student in (9).

(9)  a. Five students walked into a room.  #Then, the student sat down.  
    b. Five people walked into a room.  Then, the student sat down.  
    c. In class today, Professor Smith called the student by his last name.  

In (9a), the student cannot be anaphoric on five students, though if it were numberless such an anaphoric relation would be expected to be possible.  the student denoting the five students who walked in.  In (9b) we see that the problem is not merely one of syntactic number agreement.  Here, as in (9a), we have a syntactically singular definite description anaphoric on a plural antecedent, and yet the absence of syntactic number agreement does not block an anaphoric interpretation of the definite description.  However, the anaphoric interpretation of the student does give rise to a presupposition that of the five people who walked into the room exactly one was a student, and this presupposition is left unexplained if the determiner is semantically numberless.  Finally, in non-anaphoric uses of definite descriptions as in (9c) as well we find a uniqueness presupposition associated with the definite description, and once again this presupposition is left unexplained if the determiner is taken to be semantically numberless.

The preceding observations strongly suggest that the overt definite determiner is number sensitive in all of its occurrences.  We have already seen in (6) - (8), however, that incomplete definite descriptions do not give rise to the same uniqueness presuppositions that complete definite descriptions do in donkey anaphora environments.  This suggests that different mechanisms are needed to account for the anaphora in the two cases.  The parallel behavior of pronouns and incomplete definite descriptions further suggests that pronominal anaphora employs mechanisms similar to those involved with incomplete definite descriptions.  Neale's analysis gives us no obvious directions to turn to for such an analysis.  Therefore, I turn instead to dynamic approached to binding.

3. Dynamic Binding

\(^2\) With a little persistence, a non-contradictory interpretation can be coerced for this example as well, though the difficulty involved in obtaining this interpretation sets (c) apart from (a) and (b).
In this section, I sketch the outline of an analysis of definite description anaphora which can account for the distinctions in (6) - (8). Following Groenendijk & Stokhoff (1990, 1991) and Chierchia (1992, 1995?), I take donkey anaphoric pronouns such as those in (1) and (6a) - (8a) to be interpreted as variables which are dynamically bound by their antecedents. Following Chierchia, I use underlining to indicate dynamic connectives and quantifiers. Under these approaches, the anaphoric interpretation of the pronoun in (1) derives from a representation such as (1A).

\[(1A)\quad [\text{Every } x: \text{man} (x) \& [a\ y: \text{donkey} (y)] (x \text{ bought } y)] (x \text{ vaccinated } y)\]

Simplifying somewhat, (1A) is interpreted as a function from an input variable assignment function \(g\) to an output variable assignment \(g'\). The universal quantifier \(\text{Every } x: \text{man} (x)\) imposes the requirement that \(g = g'\). That is, the sentence as a whole does not change any of the variable assignments that it starts with, making it impossible for any expression contained within the sentence to act as if it binds an expression outside the sentence. Internal to the sentence things are different. The dynamic existential quantifier \(\exists y: \text{donkey} (y)\) introduces a variable assignment function \(h\) which differs from \(g\) at most in that it assigns to the variable \(y\) an individual satisfying the restriction \(\text{donkey} (y)\). This change naturally affects the interpretation of the occurrence of \(y\) in the immediate scope of the quantifier as in standard static interpretations of quantifiers. However, under a dynamic approach to binding, it can also affect the interpretation of the occurrence of \(y\) in the matrix clause. This is accomplished by assigning an interpretation to \(\text{every}\) which allows it to effectively pass the variable assignment function introduced within its restrictive clause on to the matrix clause. If the matrix clause in (1A) is interpreted with respect to assignment \(h\), then the value assigned to \(y\) in the matrix clause with be the same as that assigned to \(y\) in the nuclear scope of the existential quantifier. (See ??? (19??) and Kanazawa (1994?) for details.)

The dynamic binding analysis of donkey anaphora can be extended to account for the anaphoric interpretation of incomplete definite descriptions such as those in (5) and (6b) - (8b) by analyzing these latter expressions as containing a covert bindable variable:

\[(10)\quad [[\text{NP the } N]] = \text{the maximal } x \text{ such that } [[N]](x) \& x \Pi y^3\]

The notion of maximality relevant for this interpretation is given in (11).

\[(11)\quad \text{the maximal } x \text{ such that } \phi(x) =_{df} \text{that } x \text{ such that } (\phi(x) \& \forall y (\phi(y) \rightarrow y \Pi x)) \text{ if such an } x \text{ exists, else undefined}\]

Incorporating the interpretation of incomplete definite descriptions in (10) into a dynamic analysis of binding gives rise to the following as a potential representation for (5).

\[(12)\quad [\text{Every } x: \text{man} (x) \& [a\ y: \text{donkey} (y)] (x \text{ bought } y)] (x \text{ vaccinated the maximal } z\text{ such that donkey} (z) \& z \Pi y)\]

Here, the variable \(y\) that was introduced free in (10) is dynamically bound by the existentially quantified expression \(a\ \text{donkey}\) exactly as \(y\) was dynamically bound in (1A). If we assume that \(y\) is lexically restricted to atomic individuals by the determiner \(a\), then the maximal \(z\text{ such that donkey} (z) \& z \Pi y\) is equivalent to \(y\) just in case \(y\) is a donkey. Since \(y\) is independently restricted to being a donkey in (12), the synonymy of (1) and (5) follows.

\[\text{Note: } x \Pi X \text{ reads } x \text{ is a part of } y, \text{ where } y \text{ is taken to be a variable ranging over (atomic and non-atomic) plurals. In this paper, I will only be concerned with cases in which } x \text{ is atomic, a restriction imposed whenever } N \text{ is singular. The analysis is intended to cover plural descriptions as well, though I ignore these here. In contrast to Neale (1990), I interpret definite descriptions in situ as simple referring expressions.}\]
I have so far concentrated on accounting for the parallel interpretation between pronouns and incomplete definite descriptions as donkey anaphors. This still leaves the second half of the problem to be addressed -- how to distinguish incomplete definite descriptions from their complete counterparts. Simply interpreting the relative clause of a complete definite description as an additional restriction on its referent as in (13) will not suffice.

\((13) \quad \text{[[NP the N WH }] \ = \ \text{the maximal x such that }[[N]](x) \land [[\varphi]](x) \land x \Pi y^4\)

Using this as our interpretation would give rise to (14) as a representation for (3).

\((14) \quad \text{[Every x: man (x) & [a y: donkey (y)] (x bought y)] (x vaccinated the maximal z such that donkey (z) & x bought z & z \Pi y)}\)

This will result in an interpretation which is synonymous with (1A) and (12) just in case the maximal z such that donkey (z) & x bought z & z \Pi y is equivalent to y. Unfortunately, such an equivalence is guaranteed within the dynamic approaches under consideration since y is required to be atomic and is restricted to being a donkey by the quantifier a donkey, and the only variable assignments with respect to which the matrix clause is interpreted are those which also verify the nuclear scope of a donkey, viz. those which verify x bought y.

To obligatorily generate the uniqueness presupposition for (3) that was successfully avoided for (1) and (5), it suffices to eliminate the final conjunct x \Pi y in the interpretation of the complete definite description in (13), yielding (!15).

\((!15) \quad \text{[[NP the N WH }] \ = \ \text{the maximal x such that }[[N]](x) \land [[\varphi]](x)}\)

Without the conjunct z \Pi y in (14), the only way that z could be maximal and singular is if there is exactly one z such that z is a donkey that x bought. With x bound by every x: man (x), the maximality requirement on z will then be met only if each man who bought a donkey bought exactly one.

This brings us to our final question: what accounts for the presence of x \Pi y in (10), and why doesn't this same restriction occur in (!15)? I propose that this restriction arises as a result of the semantically requiring a relative clause. For definite descriptions lacking an overt relative, a covert relative is added with the interpretation \(\lambda x.x \Pi y\). Definite descriptions containing an overt relative, in contrast, have no need for a covert relative. Under plausible assumptions about the interaction of syntax, semantics and pragmatics, addition of such a covert relative will thereby be blocked.

4. Conclusion
I have argued in this paper that complete definite descriptions do but incomplete definite descriptions do not give rise to uniqueness presuppositions when employed as donkey anaphoric expressions. I further argued that an analysis which posits that some occurrences of definite descriptions can be numberless cannot by itself explain this distinction. Since incomplete definite descriptions pattern identically to pronouns in donkey anaphora environments, this calls into serious doubt the claim that pronouns are interpreted as numberless descriptions.

On the constructive side, I showed how a minimal extension of dynamic binding can account for the distinction between complete defines on the one hand and incomplete defines and pronouns on the other. While I have not here defended the analysis presented against other possible alternatives, the possibility of explaining the observed distinctions

\(^4\) WH is taken to be a relative operator and \(\varphi\) a relative clause minus WH.
within a dynamic framework lends indirect support to this framework. How far this analysis can be pushed I leave for future research.