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DESCRIPTIVE PRONOUNS AND DONKEY ANAPHORA*

It is widely held that the following so-called “donkey sentences” create insurmountable semantical problems for traditional accounts of quantification and anaphora:

- (1) Every man who bought a donkey vaccinated it.
- (2) If John buys a donkey he vaccinates it.

(i) Gareth Evans¹ has argued that the anaphoric relation between ‘a donkey’ and ‘it’ in (1) cannot be captured by a theory that treats the subject expression ‘every man who bought a donkey’ as a “logical unit,” i.e., as a restricted quantifier. (ii) Several philosophers and linguists have argued that Evans’s own pioneering approach to pronouns and anaphora is undermined by the anaphoric relations in (1) and (2).² (iii) It has been argued that the same anaphoric relations thwart a unitary Russellian (i.e., existential) analysis of indefinite

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¹ “Pronouns, Quantifiers, and Relative Clauses (I),” *Canadian Journal of Philosophy*, VII, 3 (1977): 467–536, and *The Varieties of Reference* (New York: Oxford, 1982).

² See, e.g., Irene Heim, *The Semantics of Definite and Indefinite Noun Phrases* (New York: Garland, 1988), pp. 44–102; Barry Richards, “On Interpreting Pronouns,” *Linguistics and Philosophy*, VII, 3 (1984): 287–324; and George Wilson, “Pronouns and Pronominal Descriptions: A New Semantical Category,” *Philosophical Studies*, XLV, 1 (1984): 1–30. Heim’s book contains a lucid and comprehensive account of the recent history of donkey anaphora.

descriptions.³ (iv) It has even been argued that such anaphoric relations warrant a "radical departure from existing frameworks" and "a major revision of semantic theory."⁴

By pulling together and refining some quite simple ideas that have appeared in the philosophy and linguistics literature, I want to suggest that sentences like (1) and (2) do not force us to abandon our standard conceptions of quantification and anaphora. In particular, I want to suggest that one can pursue the general approach to pronominal anaphora that Evans pioneered without abandoning either Bertrand Russell's semantics for indefinite descriptions or a general treatment of quantified noun phrases as restricted quantifiers. Evans's original theory is flawed in several ways; but some very natural modifications lead to a more interesting theory that provides plausible accounts of sentences (1) and (2) as well as some rather more complex examples.

I. WHAT IS THE PROBLEM OF DONKEY ANAPHORA?

On Russell's⁵ account, indefinite descriptions (or "indefinites" for short) are devices of existential quantification. On this account, the logical form of (3) might be rendered as (3₁):

(3) Every man who bought a donkey was happy.

(3₁) $(\forall x)((\text{man } x \ \& \ (\exists y)(\text{donkey } y \ \& \ x \text{ bought } y)) \supset x \text{ was happy})$ ⁶

By the familiar equivalence between $\lceil (\exists x \phi) \supset \psi \rceil$ and $\lceil (\forall x)(\phi \supset \psi) \rceil$, where ψ contains no free occurrences of x , (3₁) is logically equivalent to:

³ Hans Kamp, "A Theory of Truth and Semantical Representation," in J. Groenendijk, T. Janssen, and M. Stokhof, eds., *Truth, Interpretation and Information* (Dordrecht: Foris, 1984), pp. 1–41; Heim; and Wilson. The truth of this claim is also assumed by Jon Barwise, "Noun Phrases, Generalized Quantifiers, and Anaphora," in P. Gärdenfors, ed., *Generalized Quantifiers* (Dordrecht: Reidel, 1987), pp. 1–29.

⁴ Kamp, p. 2; see also Barwise.

⁵ *Introduction to Mathematical Philosophy* (London: Allen & Unwin, 1918), pp. 167–172. For detailed commentary, cf. Ludlow and Neale, "Indefinite Descriptions: In Defense of Russell" (forthcoming).

⁶ The fiction that the unrestricted quantifiers \exists and \forall suffice for treating quantification in natural language will be dropped in section II. There appears to be another reading of (1) on which the existential quantifier introduced by 'a donkey' is given wide scope; but this is not the reading we are interested in here. (A wide-scope reading comes through more clearly in (i) Every man who saw a painting I bought was excited. It is important not to confuse the idea that the indefinite description in (i) may take wide scope with the idea that it admits of a semantically referential interpretation. As Saul Kripke has emphasized [in "Speaker's Reference and Semantic Reference," in P. A. French, T. E. Uehling, and H. K. Wettstein, eds., *Contemporary Perspectives in the Philosophy of Language* (Minneapolis: Minnesota UP, 1977), pp. 6–27], interpreting a definite or indefinite description as taking wide scope is not at all the same thing as interpreting it referentially.)

(3₂) $(\forall x)(\forall y)((\text{man } x \ \& \ \text{donkey } y \ \& \ x \ \text{bought } y) \supset x \ \text{was happy})$

Now consider (1):

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

where 'it' is understood as anaphoric on 'a donkey'. Following P. T. Geach,⁷ it is pretty generally agreed that, on its most salient reading, (1) is true if and only if every man who bought at least one donkey vaccinated every donkey he bought. And, again following Geach (and also W. V. Quine⁸), it is widely held that pronouns anaphoric on quantified noun phrases function as *bound variables*. We might therefore render (1) as (1₂):

(1₂) $(\forall x)(\forall y)((\text{man } x \ \& \ \text{donkey } y \ \& \ x \ \text{bought } y) \supset x \ \text{vaccinated } y)$

Now, despite the equivalence noted above, there is no first-order formula that is to (1₂) as (3₁) is to (3₂). The "closest" we get is (1₁):

(1₁) $(\forall x)((\text{man } x \ \& \ (\exists y)(\text{donkey } y \ \& \ x \ \text{bought } y)) \supset x \ \text{vaccinated } y)$

in which the final occurrence of *y* lies outside the scope of the existential quantifier that ought to be binding it. It would seem, then, that we cannot represent (1) with a formula that reflects an existential treatment of 'a donkey' (on the intended reading). Consequently, a uniform Russellian analysis of indefinite descriptions would seem to be thwarted.⁹

The existential treatment of indefinite descriptions works so well elsewhere that we should think very hard before giving it up or substantially modifying it. Not only does it work for indefinites that are subjects, or direct or indirect objects of simple sentences, it also works for indefinites in restrictive relative clauses, as in (3). But when there is anaphora on an indefinite contained in a relative clause, as in

⁷ *Reference and Generality* (Ithaca: Cornell, 1962), pp. 126ff. Geach focuses primarily on conditionals of the form 'If any man buys a donkey he vaccinates it'. It should be clear that, contrary to what is claimed by, e.g., Norbert Hornstein [in *Logic as Grammar* (Cambridge: MIT, 1984)], the phenomenon under investigation is not something that arises only when the indefinite description requires a so-called "generic" or "quasi-generic" reading. This is the reason I have used sentence (1) rather than, say, 'Every man who buys a donkey vaccinates it', which apparently admits of a "quasi-generic" reading.

⁸ *Word and Object* (Cambridge: MIT, 1960).

⁹ Positing a full-blown ambiguity in the indefinite article will not help; there is simply no reading of, e.g., 'A man from London came to see me last night', or 'I met a doctor in Spain', in which the indefinite has universal force. The ambiguity theory is also susceptible to criticisms raised by Jaakko Hintikka and Lauri Carlson, "Conditionals, Generic Quantifiers, and Other Applications of Subgames," in F. Guenther and S. J. Schmidt, eds., *Formal Semantics and Pragmatics for Natural Language* (Dordrecht: Reidel, 1978), pp. 1-36.

(1), we must apparently resign ourselves to a treatment of the indefinite as a device of universal quantification.

We find a similar situation in conditionals. Consider:

(4) If John buys a donkey he is happy.

If we follow the common practice of taking a conditional to be composed of two sentences and a binary sentential connective, and then take the pronoun 'he' in the consequent of (4) to refer to John, we might assign to (4) the following logical form:

(4₁) $(\exists x)(\text{donkey } x \ \& \ \text{John buys } x) \supset \text{John is happy}$

(For present purposes, I propose to put aside the question of how well the material conditional fares.) By the familiar equivalence again, (4₁) is equivalent to (4₂):

(4₂) $(\forall x)((\text{donkey } x \ \& \ \text{John buys } x) \supset \text{John is happy})$

Notice that the scope of the existential quantifier in the antecedent of (4₁) does not extend to the consequent; in a word, its scope is *clausal*. It should come as no surprise, then, that, if the consequent contains a pronoun that is anaphoric on the indefinite description in the antecedent, that pronoun will not be captured by the existential quantifier. Take:

(2) If John buys a donkey he vaccinates it.

If the indefinite is treated existentially and if 'it' is treated as a variable, (2) comes out as:

(2₁) $(\exists x)(\text{donkey } x \ \& \ \text{John buys } x) \supset \text{John vaccinates } x$

in which the final occurrence of x lies outside the scope of the existential quantifier that ought to be binding it. It is not difficult to find a sentence of first-order logic that gives us the right truth conditions:

(2₂) $(\forall x)((\text{donkey } x \ \& \ \text{John buys } x) \supset \text{John vaccinates } x)$

Again, the indefinite must apparently be treated as introducing wide-scope universal quantification.

But there is a *prima facie* absurdity in the claim that indefinite descriptions in certain subordinate structures—restrictive relative clauses and the antecedents of conditionals—have universal rather than existential import. As (3) and (4) make clear, it is just false that every indefinite description that occurs in such a position requires a universal interpretation. The problem seems to arise only when there is anaphora of the sort exemplified in (1) and (2).

From the point of view of just capturing the truth conditions of (1) and (2) (and some related sentences), it will, perhaps, suffice to treat indefinite descriptions as introducing universal quantification when (and only when) they are constituents of certain subordinate structures. But the weakness of this approach is clear. Insofar as we are seriously engaged in the construction of a semantical theory for a learnable language, we must aim for more than such a limited brand of truth-conditional adequacy. We want a systematic deliverance of truth conditions, a theory that projects the truth conditions of sentences on the basis of the "meanings" of their parts and their syntactical structures. And, on this score, treating indefinite descriptions in (and only in) certain subordinate structures as devices of wide-scope universal quantification is, at best, a tottering first step. Such a treatment gives us no explanation of the apparent "universalization" in (1) and (2).

I want to explore the idea that the "universalization" of the indefinite descriptions in (1) and (2) is a logical illusion. In particular, I want to explore the idea that it is the anaphoric pronoun (rather than the indefinite description) that has a universal character. The existence of sentences like the following suggests that this might be a good way to proceed:

- (5) Every man who bought *two or more donkeys* vaccinated *them*.
 (6) If John buys *several donkeys* he vaccinates *them*.

Here again there is "universalization." Take (5); this is true just in case every man who bought two or more donkeys vaccinated every donkey he bought.¹⁰ But we cannot capture this fact by treating 'two or more donkeys' as a wide-scope quantifier—universal or otherwise—that binds 'them'. If the quantifier were universal, (5) would be equivalent to (1), which it is not;¹¹ if the quantifier were 'two or more', (5) would mean that there are two or more donkeys such that every man who bought them vaccinated them, which it does not. All this suggests very strongly that, if we are to understand what is going on in (1), (2), (5), and (6), we need to think about the semantics of the anaphoric pronouns, not the semantics of their antecedents.

¹⁰ The fact that we find "universalization" in sentences containing quantified phrases other than indefinite descriptions is noted by Gilbert Harman, "Deep Structure as Logical Form," in D. Davidson and G. Harman, eds., *Semantics of Natural Language* (Dordrecht: Reidel, 1972), pp. 25–47; see also James Higginbotham and Robert May, "Crossing, Markedness, Pragmatics," in A. Belletti, L. Brandi, and L. Rizzi, eds., *Theory of Markedness in Generative Grammar* (Pisa: Scuola Normale Superiore, 1981), pp. 423–444.

¹¹ This problem generalizes, of course, to all sentences of the form 'Every man who bought *n or more donkeys* vaccinated *them*', for arbitrary *n*.

II. RESTRICTED QUANTIFICATION

The inadequacies of the unrestricted unary quantifiers \forall and \exists for treating quantification in natural language are well-known. With the aid of the binary sentential connectives ' \supset ' and '&', restricted quantifications of the form 'All F s are G s' and 'Some F s are G s' can be expressed; but as Nicholas Rescher¹² has shown, there is no connective that will work for a unary quantifier designed to capture the semantics of 'most', for example. It is natural, therefore, to treat the determiners 'every', 'most', 'some', 'the', 'no', etc., as devices that combine, in some fashion, with two predicates to form a sentence. There are two standard ways of formalizing this idea, what I shall call BQ and RQ. According to BQ, formally a determiner is a *binary quantifier*, a device that combines directly with a pair of formulae to form another formula.¹³ According to RQ, a determiner is a device that combines with a formula to form a restricted unary quantifier; and a restricted quantifier combines with a second formula to form another formula.¹⁴ Consider the following sentence:

(7) Every man was happy.

Putting quantifiers inside square brackets and the formulae with which they combine inside parentheses, in RQ notation (7) comes out as (7_{RQ}) , and in BQ notation it comes out as (7_{BQ}) :

(7_{RQ}) [every x : man x](x was happy)

(7_{BQ}) [every x](man x : x was happy)

Notational variants, one would naturally think. Translation between formulae of the two systems looks easy enough, even for more complex examples such as (3):

¹² "Plurality Quantification," *Journal of Symbolic Logic*, xxvii, 3 (1962): 373-4. Furthermore, 'most F s' is not definable in first-order logic at all, even over finite domains [see, e.g., Barwise and Robin Cooper, "Generalized Quantifiers and Natural Language," *Linguistics and Philosophy*, iv, 2 (1981): 159-219].

¹³ See, e.g., Evans, *op. cit.*, and "Pronouns, Quantifiers, and Relative Clauses (II)," *Canadian Journal of Philosophy*, 7 (1977): 777-797; David Wiggins, "'Most' and 'All': Some Comments on a Familiar Programme, and on the Logical Form of Quantified Sentences," in M. Platts, ed., *Reference, Truth, and Reality* (New York: Routledge & Kegan Paul, 1979), pp. 318-346; and Martin Davies, *Meaning, Quantification, Necessity* (New York: Routledge & Kegan Paul, 1981). It should be remarked that these quantifiers are "binary" not in the standard sense that they simultaneously bind two distinct variables [see Andrej Mostowski, "On a Generalization of Quantifiers," *Fund. Math.*, XLIV (1957) 12-36], but in the sense that they combine with pairs of formulae to form formulae.

¹⁴ See, e.g., Higginbotham and May, "Questions, Quantifiers, and Crossing," *The Linguistic Review*, 1, 1 (1981): 41-80; and Barwise and Cooper.

- (3) Every man who bought a donkey was happy.
 (3_{RQ}) [every x : man x & [a y : donkey y](x bought y)](x was happy)
 (3_{BQ}) [every x](man x & [a y](donkey y : x bought y):(x was happy))¹⁵

It would seem safe to assume, then, that once the syntax and semantics of BQ and RQ are fleshed out, the systems will be equivalent in expressive power and congruent in respect of semantical utility.

Evans¹⁶ has contested this assumption. Again, it is the anaphoric relation in sentence (1) that apparently causes the trouble:

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

According to Evans, (a) there are knock-down arguments for a sharp distinction between bound and unbound anaphoric pronouns, (b) the pronoun 'it' in (1) is unbound, and (c) if the pronoun 'it' in (1) is an unbound anaphor, the semantical connection between antecedent and anaphor can be forged in BQ but not in RQ. As we shall see, Evans is wrong on this last point. The only interesting difference between BQ and RQ is that the latter allows us to view quantified noun phrases like 'every man', 'every man who bought a donkey', etc., as syntactical and semantical units. Consequently, its formulae tend to be easier to parse, and for this reason RQ is the system I shall adopt.

For present purposes, only the barest outlines of RQ are necessary. Let us informally modify the formation rules of a standard first-order language by replacing the rules concerning \exists and \forall with the following:

- (Q1) If ϕ is a well-formed formula that contains at least one occurrence of a term b and no occurrence of (the variable) x , and if D is a determiner, then $\lceil Dx: \phi/x \rceil$ is a well-formed quantifier phrase (where $\lceil \phi/x \rceil$ is the result of replacing at least one occurrence of b in ϕ by x).
- (Q2) If ψ is a well-formed formula that contains at least one occurrence of a term b and no occurrence of x , and if $\lceil Dx: \phi \rceil$ is a well-formed quantifier phrase, then $\lceil Dx: \phi \rceil (\psi/x)$ is a well-formed formula (where $\lceil \psi/x \rceil$ is the result of replacing at least one occurrence of b in ψ by x).¹⁷

¹⁵ The mechanisms involved in spelling out the semantics of restrictive relative clauses will be addressed in section vi.

¹⁶ In "Pronouns, Quantifiers, and Relative Clauses (I)," pp. 136–9, and in *The Varieties of Reference*, pp. 58–9.

¹⁷ In place of (Q1) and (Q2), BQ will have the following: (*) If ϕ and ψ are well-formed formulae, each of which contains at least one occurrence of b and no occurrence of x , and if D is a determiner, then $\lceil Dx \rceil (\phi/x; \psi/x)$ is a well-formed formula.

The notion of variable-binding operative in (Q1) and (Q2) is straightforward. We have two types of variable-binding operator, determiners and quantifiers. A determiner Dx binds every free occurrence of x in the formula with which it combines to form a quantifier. And a quantifier $\lceil [Dx: \phi] \rceil$ binds every free occurrence of x in the formula with which it combines to form a formula. Using this notation, we can perspicuously and unambiguously represent the quantificational structures of sentences with more than one quantifier, the scope of such devices being understood exactly as in first-order logic. For example, the alleged ambiguity in (8) is captured by (8₁) and (8₂):

(8) Every boy danced with a girl.

(8₁) $\lceil \text{every } x: \text{boy } x \rceil \lceil \text{[a } y: \text{girl } y \rceil (x \text{ danced with } y) \rceil$

(8₂) $\lceil \text{[a } y: \text{girl } y \rceil \lceil \text{[every } x: \text{boy } x \rceil (x \text{ danced with } y) \rceil \rceil$ ¹⁸

We can now write some sample truth clauses. If $|F|$ is the cardinality of F , and F is the set of things that are F , then:

(*1) $\lceil \text{[every } x: Fx \rceil (Gx) \rceil$ is true iff $|F - G| = 0$

(*2) $\lceil \text{[no } x: Fx \rceil (Gx) \rceil$ is true iff $|F \cap G| = 0$

(*3) $\lceil \text{[some } x: Fx \rceil (Gx) \rceil$ is true iff $|F \cap G| \geq 1$

(*4) $\lceil \text{[an } x: Fx \rceil (Gx) \rceil$ is true iff $|F \cap G| \geq 1$

(*5) $\lceil \text{[most } x: Fx \rceil (Gx) \rceil$ is true iff $|F \cap G| > |F - G|$

[I have not attributed existential import to $\lceil \text{every } F \rceil$; if it is wanted, add "and $|F| \geq 1$ " to the right hand side of (*1).]

Following a suggestion made by Arthur Prior,¹⁹ Russell's brilliant insight that definite descriptions are quantificational rather than

¹⁸ By using the resources of a semantically well-understood and perspicuous notation, the semanticist is not committed to a notion of "Logical Form" (LF) construed as a level of syntactical representation. The work of Noam Chomsky, Higginbotham, May, and others suggests very strongly, however, that a variety of subtle facts about anaphora, quantification, and variable binding can be explained neatly on the assumption that there is such a level of syntactical representation. See Chomsky, *Lectures on Government and Binding* (Dordrecht: Foris, 1981); Higginbotham, "Pronouns and Bound Variables," *Linguistic Inquiry*, XI, 4 (1980): 679–708, and "The Logic of Perceptual Reports: An Extensional Alternative to Situation Semantics," this JOURNAL, LXXX, 2 (February 1983): 100–127; May, *Logical Form: Its Structure and Derivation* (Cambridge: MIT, 1985); and Higginbotham and May, *op. cit.* For an elementary exposition, see *Descriptions*, ch 5.

¹⁹ "Is the Concept of Referential Opacity Really Necessary?" *Acta Philosophica Fennica*, XVI (1963): 189–198. The same suggestion is also made by Paul Grice, "Vacuous Names," in Davidson and Hintikka, eds., *Words and Objections* (Dordrecht: Reidel, 1969), pp. 118–145, and by Richard Sharvy, "Things," *The Monist*,

referential is captured by treating 'the F ' as a restricted quantifier \lceil [the $x: Fx$] \rceil , i.e., by treating the determiner 'the' as a member of the same syntactical and semantical category as 'every', 'no', 'some', 'a', 'most', etc. According to Russell,²⁰ the logical form of \lceil the F is $G \rceil$ is given by:

$$(9) (\exists x)(Fx \ \& \ (\forall y)(Fy \supset y = x) \ \& \ Gx)$$

As Russell points out, on this account, a definite descriptions is really a complex indefinite description, i.e., an existentially quantified noun phrase with a uniqueness condition built in. But we should not become preoccupied with the existential character of the analysis. As (9) makes clear, it is by introducing universal quantification that the implication of uniqueness is captured: \lceil the F is $G \rceil$ is true if and only if (i) all F s are G s and (ii) there is exactly one F . In other words, definite descriptions are as universal as they are existential. And as Noam Chomsky²¹ has pointed out, if we focus on universality, the relationship between singular and plural descriptions comes clearly into view. Intuitively, there is just a cardinality difference between the truth conditions of a sentence containing a singular description and those of the corresponding sentence containing the description in its plural form. For 'the F is G ' to be true there must be exactly

LIII, 4 (1969): 488–504. Attempts to incorporate this idea into a general syntactical and semantical account of quantifiers in natural language can be found in Richard Montague, "English as a Formal Language," in Richmond Thomason, ed., *Formal Philosophy: Selected Papers of Richard Montague* (New Haven: Yale, 1974), pp. 108–221; and, in a more recent syntactical setting, in Higginbotham and May, "Questions, Quantifiers, and Crossing."

²⁰ "On Denoting," *Mind*, XIV, (1905): 479–493; and A. N. Whitehead and Bertrand Russell, *Principia Mathematica*, I (New York: Cambridge, 2nd ed., 1927), pp. 173ff. It is sometimes suggested that the theory of descriptions is too cumbersome and unwieldy to merit a place in a serious compositional semantics for natural language. Such a charge puts too much weight on the particular formalism of *Principia Mathematica*, and not enough on the genuine semantical insights of the theory itself. Russell's semantics for descriptions is quite compatible with the view that descriptions are restricted quantifiers (see below).

For the purposes of this paper, I am going to assume that Russell's theory of descriptions provides a more or less correct account of the semantics of definite descriptions in natural language on at least one of their uses. It is irrelevant to present concerns whether or not an additional semantically referential reading is required in order to make sense of cases involving so-called "referential" uses of descriptions. Following the lead of Grice and Kripke, in *Descriptions* I argue that referential usage is of no semantical import; nothing turns on this here. It should also be pointed out that endorsing Russell's theory of descriptions involves no commitment to a sense-datum epistemology or to a descriptive analysis of proper names.

²¹ "Questions of Form and Interpretation," *Linguistic Analysis*, I, 1 (1975): 75–109.

one F ; for \lceil the F s are G s \rceil to be true there must be more than one F .²² The following truth clauses make the relationship transparent:

(*6) Where ' F ' is singular:

$$\lceil \text{the } x: Fx \rceil (Gx) \rceil \text{ is true iff } |F - G| = 0 \text{ and } |F| = 1$$

(*7) Where ' F ' is plural:

$$\lceil \text{the } x: Fx \rceil (Gx) \rceil \text{ is true iff } |F - G| = 0 \text{ and } |F| > 1^{23}$$

Let us now allow for the possibility of "numberless" or "neutral" descriptions, that is, descriptions that are, from a semantical perspective, neither singular nor plural, i.e., silent on whether $|F| = 1$ or $|F| > 1$. Although English nouns and verbs are typically marked for number, the language may well contain numberless descriptions. Phrases of the form 'whoever is F ' are quite possibly such descriptions. As G. E. Moore²⁴ remarked, \lceil whoever is F is G \rceil entails nothing about uniqueness; it might be paraphrased as \lceil the person (or persons) who is (or are) F is (or are) G \rceil , which makes clear its neutrality as to semantical number. Let us use \lceil [whe $x: Fx$] \rceil for a numberless description:

(*8) \lceil [whe $x: Fx$] $\rceil (Gx) \rceil$ is true iff $|F - G| = 0$ and $|F| \geq 1$

²² It is well-known that some sentences containing plural noun phrases like 'Russell and Whitehead', 'a man and a woman', 'the men', 'three women', and so on admit of (or require) collective or group readings. The task of providing an adequate semantics for plural noun phrases that admit of such readings is clearly a very general task that has nothing to do with descriptions per se, and to that extent I shall not attempt to say anything significant about collective readings of descriptions here.

²³ To treat a singular definite description \lceil the F \rceil as a restricted quantifier \lceil the $x: Fx$ \rceil is not to propose an alternative to Russell's theory; it is just to find a more congenial method of stating it. In effect, (*6) stipulates that \lceil the $x: Fx$ $\rceil (Gx) \rceil$ is equivalent to $\lceil (\exists x)(Fx \ \& \ (\forall y)(Fy \supset y = x) \ \& \ Gx) \rceil$. We are not, by virtue of being Russellians, committed to the view that the relevant sentences must be beaten into sentences of the language of *Principia Mathematica*. From the point of view of explicating logical structure, treating descriptions as restricted quantifiers, results not in a clash with Russell but in an explanation of where the theory of descriptions fits into a more general theory of natural language quantification, a theory in which determiners are treated as members of a unified syntactical and semantical category.

²⁴ "Russell's 'Theory of Descriptions'," in P. A. Schilpp, ed., *The Philosophy of Bertrand Russell* (New York: Tudor, 1944), pp. 177-225. Syntactically, of course, 'whoever' is singular, at least if verb agreement is anything to go by, witness the third person singular inflections on 'buys' and 'is' in, e.g., 'Whoever buys this is getting a bargain'. Apparently, some languages exploit the possibility of numberless descriptions on a far greater scale. Of course, if there are no singular or plural descriptions in these languages, it will not always be clear what counts as evidence for numberless descriptions, rather than systematic ambiguity between singular and plural descriptions. It is surely because English nouns (and verbs) are typically marked for number that we treat 'the sheep' as ambiguous rather than numberless.

The importance of numberless descriptions will become clear in sections VI and VII. Right now, we need to turn to pronouns anaphoric on quantifiers and to the relationship between pronouns and definite descriptions.

III. BOUND ANAPHORS

Following Geach and Quine, it is widely held that pronouns anaphoric on quantified noun phrases function like the bound variables of quantification theory. As Evans²⁵ has argued, however, not all pronouns with quantified antecedents can be treated in this way. Consider:

(10) John bought *some donkeys* and Harry vaccinated *them*.

If the pronoun 'them' is treated as a variable bound by 'some donkeys', the logical form of (10) will be:

(10₁) [some x : donkeys x](John bought x & Harry vaccinated x)

Evans points out that this is wrong on several related counts. First, (10₁) can be true even if Harry did not vaccinate all of the donkeys John bought, whereas (10) cannot [if John bought ten donkeys and Harry vaccinated only two of them, (10₁) would be true whereas (10) would not]. The bound proposal simply delivers the wrong truth conditions. As a corollary, it runs into a further problem that it will be fruitful to explore. A conjunction is true if, and only if, both of its conjuncts are true; so if (10) is true, so is (11):

(11) John bought some donkeys.

The bound analysis does in fact make the right prediction here, because (11₁), which represents (11), is a consequence of (10₁):

(11₁) [some x : donkeys x](John bought x)

But this is solely due to the choice of example. Consider the following:

(12) John bought *exactly two donkeys* and Harry vaccinated *them*.

(13) *Just one man* drank rum and *he* was ill afterward.

Take (13); if this sentence is true, then so is (14):

(14) Just one man drank rum.

But the bound analysis misfires here. If the scope of the quantifier

²⁵ "Pronouns, Quantifiers, and Relative Clauses (I)." See also his "Pronouns," *Linguistic Inquiry*, XI: 337-362.

phrase 'just one man' is extended to the second conjunct, so as to capture the pronoun 'he', (13) will come out as (13₁):

(13₁) [just one x : man x](x drank rum & x was ill)

But (13₁) captures the truth conditions of (15):

(15) Just one man drank rum and was ill.

And unlike (13), the truth of (15)/(13₁) is quite compatible with the falsity of (14). [For example, (15)/(13₁) can be true if two (or more) men drank rum, but obviously (14), and hence (13), cannot.] Indeed, whenever a quantified antecedent is not monotone increasing the bound analysis will fail in this way.²⁶ With antecedents of the form 'no F s' the problem is especially acute. The bound analysis predicts that the incoherent (16) is equivalent to (17):

(16) John bought *no donkeys* and Harry vaccinated *them*.

(17) John bought no donkeys that Harry vaccinated.

Of course, if cross-sentential binding is prohibited, these problems do not arise. The upshot of all this is that, among those pronouns anaphoric on quantifiers, we need to distinguish between those which are bound (in the familiar sense) and those which are not.

There turns out to be a simple and precise syntactical constraint on when an anaphoric pronoun can be interpreted as a bound variable.²⁷ First, a very rough characterization: if P is a pronoun that is anaphoric on a quantifier Q , then P is bound by Q only if P is located inside the smallest clause containing Q . We can make this precise with the aid of some elementary configurational notions from contemporary grammatical theory. The first notion we need is that of dominance, which concerns the hierarchical organization of syntactical constituents. Consider the following (highly simplified) tree diagram for (18):

(18) Every man thinks (that) Mary loves him.

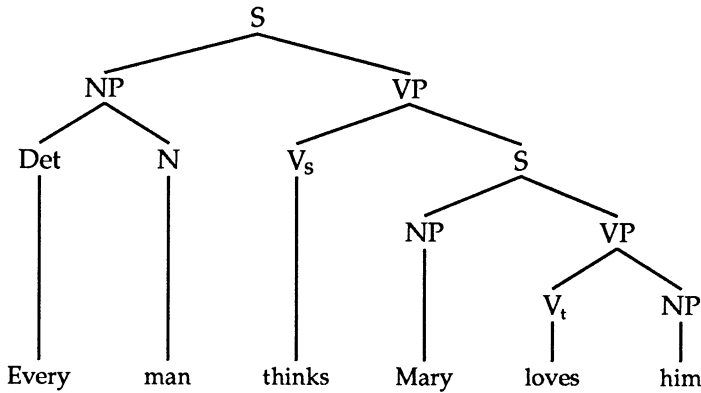
²⁶ Following Barwise and Cooper, a quantifier ' $[Dx: Fx]$ ' is monotone increasing just in case the following is a valid inference:

$$\frac{[Dx: Fx](Gx)}{[\text{every } x: Gx](Hx)}$$

$$[Dx: Fx](Hx)$$

for arbitrary G and H .

²⁷ Indeed, as Higginbotham has remarked, ultimately a simple and precise syntactical characterization of Russell's notion of the scope of a quantifier. (To say that there is a syntactical characterization of scope is not, of course, to deny that scope is a semantical phenomenon.)



A node (or point) in a syntactical tree dominates its own constituents, that is, every node beneath it that can be traced back to it. Thus, in (18) the major verb phrase (VP) dominates the sentential verb (V_s) 'thinks', and everything in the embedded sentence (S) 'Mary loves him'. And the embedded verb phrase 'loves him' dominates the transitive verb (V_t) 'loves' and the noun phrase (NP) 'him'.

The central notion we need in order to characterize bound anaphora is that of *c-command*:

- (P1) A noun phrase α c-commands a noun phrase β if and only if the first branching node dominating α also dominates β (and neither α nor β dominates the other).

By this definition, in (18) the subject NP 'every man' c-commands everything in the VP 'thinks Mary loves him'; in particular, it c-commands the pronoun 'him'.

We can now state the syntactical constraint on bound anaphora which Evans uncovers:

- (P2) A pronoun P that is anaphoric on a quantifier Q is interpreted as a variable bound by Q only if Q c-commands P .²⁸

²⁸ The 'only if' in (P2) can, I believe, be strengthened to an 'if and only if' (see *Descriptions*, ch. 5). To avoid distracting engagements, I have not used the stronger version here. For the purposes of this paper, I am making the simplifying assumption that (P2) is a constraint on surface syntax. As May and Higginbotham have stressed, however, in order to account for the anaphoric relations in examples like the following (due originally to Peter Geach and Benson Mates) (P2) must in fact hold at LF, a level of syntactical representation once removed from surface structure: (i) The man who bought *each donkey* vaccinated *it*. (ii) The father of *each girl* waved to *her*. (iii) The woman *every true Englishman* respects is *his* mother.

In (18), since the pronoun 'him' is c-commanded by 'every man', if the former is understood as anaphoric on the latter—it could be understood demonstratively—it may be interpreted as a bound variable.

Now, suppose we form a sentence S_0 from two sentences S_1 and S_2 , and a binary sentential connective like 'and', 'or', or 'if. . . then'. In such a construction, no proper constituent of S_1 will c-command anything in S_2 ; hence no pronoun in S_2 can be interpreted as a variable bound by a quantifier in S_1 . (P2) therefore gives us an account of why the pronouns in (10), (12), and (13) are not bound anaphors: they are not c-commanded by (and hence not within the scope of) their antecedents.²⁹

IV. DESCRIPTIVE ANAPHORS

We have established that the pronoun in (10) is not functioning as a bound variable:

(10) John bought *some donkeys* and Harry vaccinated *them*.

How, then, is the pronoun to be interpreted? A plausible paraphrase of (10) is (10₂):

(10₂) John bought some donkeys and Harry vaccinated *the donkeys John bought*.

This suggests to Evans that the unbound pronoun in (10) should be interpreted via the plural definite description 'the donkeys John owns', as what he calls an E-type pronoun. On this account, we might represent the logical form of (10) as (10₃):

(10₃) [some x : donkeys x](John bought x) &
[the x : donkeys x & John bought x](Harry vaccinated x)³⁰

Now, what of singular pronouns in the same environment? Consider:

(19) John bought *a donkey* and Harry vaccinated *it*.

²⁹ Furthermore, they are not c-commanded by their antecedents at the syntactical level LF.

³⁰ Strictly speaking, Evans would not endorse (10₃) as giving the logical form of (10). On his final account, E-type pronouns do not go proxy for descriptions, but rather have their references fixed by them. [On the notion of fixing reference by description, see Kripke, *Naming and Necessity* (Cambridge: Harvard, 1980), pp. 54–5.] Evans explicitly entertains and rejects the proxy view, but in due course we shall see that the proxy view is superior to Evans's view. (The idea that unbound anaphoric pronouns might stand in lieu of definite descriptions goes back at least to Quine, pp. 102–3, 113.)

Again, a paraphrase of the pronoun in terms of a description seems appropriate:

- (19₁) John bought a donkey and Harry vaccinated *the donkey John bought*.

We might, therefore, represent the logical form of (19) as follows:

- (19₂) [an x : donkey x](John bought x) &
[the x : donkey x & John bought x](Harry vaccinated x)³¹

A few brief remarks about this proposal are in order.

(i) It is intended to be a general theory that treats all unbound pronouns with quantified antecedents in the same way. Thus, the pronouns in each of the following sentences will be cashed out as descriptions constructed from the clauses containing their antecedents:

- (12) *Just one man* drank rum and *he* was ill afterward.
 (20) John found *several minor mistakes* in his proof, but he managed to correct *them* without too much difficulty.
 (21) *A few professors* came to the party. *They* seemed to enjoy themselves.³²
 (22) *The inventor of bifocals* was a genius; *he* ate a lot of fish.
 (23) *The women who came to the party* were irritated by Bill; *they* complained, in particular, about his chauvinism.

In order to provide an explicit account of these facts as well as some more complex ones we shall consider shortly, we need some

³¹ It is also open to argue, along with Kripke (in "Speaker's Reference and Semantic Reference," p. 27, fn. 32) and David Lewis [in "Scorekeeping in a Language Game," *Journal of Philosophical Logic*, VIII, 3 (1979), pp. 339–359], that some unbound pronouns anaphoric on definite and indefinite descriptions may refer to individuals raised to salience by the utterances of the sentences containing their "antecedents." (This idea was also suggested by Grice in unpublished work.) It is not necessary to see such a proposal as conflicting with the descriptive proposal. One interesting idea (due to Kripke) is that unbound pronouns anaphoric on descriptions that are used referentially may be interpreted either referentially or descriptively. (As Kripke stresses, to say that a definite or indefinite description is used referentially is not to say that the description is interpreted as semantically referential, i.e., interpreted as a referring expression.) Either way, it is not necessary to agree with P. F. Strawson [*Introduction to Logical Theory* (London, Methuen, 1952), pp. 185ff.] that definite and indefinite descriptions functioning as the antecedents of unbound anaphoric pronouns must be semantically referential.

³² In this example, the reflexive pronoun 'themselves' is bound by the descriptive pronoun 'they'.

terminology. Recall that definite descriptions, whether singular or plural, can be treated as (restricted) universal quantifiers with specified existential import: 'the F is G ' is true if and only if all F s are G s and there is exactly one F ; 'the F s are G s' is true if and only if all F s are G s and there is more than one F . As shorthand for this, let us say that the definite article is used to signal maximality, which in the case of a singular description is uniqueness. More generally, let us say that:

- (P3) A quantifier '[$Dx: Fx$]' is maximal if and only if '[$Dx: Fx$](Gx)' entails '[every $x: Fx$](Gx)', for arbitrary G .

On this account, quantifiers of the form 'the F ', 'the F s', 'each F ', 'each of the F s', 'every F ', 'all F s', etc., are maximal. Second, let us say that:

- (P4) The *antecedent clause* for a pronoun P that is anaphoric on a quantifier Q occurring in a sentence ϕ is the smallest well-formed subformula of ϕ that contains Q as a constituent.

We might now put forward the following generalization:

- (P5) If x is a pronoun that is anaphoric on, but not c-commanded by a quantifier '[$Dx: Fx$]' that occurs in an antecedent clause '[$Dx: Fx$](Gx)', 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 .³³

More usefully, (P5) can be spelled out as the conjunction of (P5_a) and (P5_b):

³³ (P5) has its origins in the generalizations offered by Evans ["Pronouns, Quantifiers, and Relative Clauses (I)," p. 111] and by Davies (p. 171), neither of which I find entirely satisfactory. The most important differences are the following: (i) Evans treats descriptive anaphors as having their references fixed by description rather than as going proxy for descriptions. For reasons given by Davies and by Scott Soames ["Review of Gareth Evans's *Collected Papers*," this JOURNAL, LXXXVI 3 (March 1989): 141–156], and recapitulated later in this section, this view must be rejected along with the "weaker" view that descriptive pronouns are equivalent to wide-scope descriptions; thus (P5) is stated in such a way that it does not preclude scope interactions between descriptive pronouns and other operators. (ii) Evans and Davies both treat determiners as binary quantifiers (Evans claims that quantified noun phrases cannot be represented as restricted quantifiers because of donkey anaphora; see section V). (iii) Evans treats unbound pronouns that are anaphoric on definite descriptions as "pronouns of laziness" rather than as E-type pronouns; (P5) is stated in such a way that it is applicable in cases where the relevant pronouns are anaphoric on singular and plural definite descriptions; if Davies's generalization is applied to such cases, it can yield incorrect results. In cases where the antecedent is not maximal, (P5) is, I believe, equivalent to Davies's generalization, *modulo* my use of restricted quantifiers. I am here indebted to Ludlow and Soames for valuable discussion.

- (P5_a) If x is a pronoun that is anaphoric on, but not c-commanded by a nonmaximal quantifier $\lceil [Dx: Fx] \rceil$ that occurs in an antecedent clause $\lceil [Dx: Fx](Gx) \rceil$, then x is interpreted as $\lceil [\text{the } x: Fx \ \& \ Gx] \rceil$.
- (P5_b) If x is a pronoun that is anaphoric on, but not c-commanded by a maximal quantifier $\lceil [Dx: Fx] \rceil$ that occurs in an antecedent clause $\lceil [Dx: Fx](Gx) \rceil$, then x is interpreted as $\lceil [\text{the } x: Fx] \rceil$.

(ii) Evans explicitly rejects the view that E-type pronouns go proxy for definite descriptions in favor of the view that they have their referents fixed by description. As Evans puts it, an E-type pronoun refers to “those objects which verify (or that object which verifies) the sentence containing the antecedent quantifier.”³⁴ Evans’s main reason for rejecting the proxy view in favor of the reference-fixing view is that he thinks E-type pronouns do not give rise to the sorts of scope ambiguities that overt descriptions delight in when they interact with other operators. According to Evans, if we take a sentence S containing an E-type pronoun P and substitute for P the favored description, the resulting sentence S' may exhibit a scope ambiguity that is not exhibited by S . Consider attitude contexts. On the proxy view, (24) will come out as (25):

- (24) A *man* murdered Smith, but John does not believe that *he* murdered Smith.
- (25) A man murdered Smith, but John does not believe that the man who murdered Smith murdered Smith.

Thus, it delivers two readings for the clause containing the anaphoric pronoun (the so-called *de re* and *de dicto* readings) according as the description delivered by (P5) is given wide or narrow scope:

- (24₁) [the x : man x & x murdered Smith]
 (John does not believe that (x murdered Smith))
- (24₂) John does not believe that
 ([the x : man x & x murdered Smith](x murdered Smith)).

Evans points out that it is natural to interpret (24) as attributing to John “merely a noncontradictory belief of the murderer that he is not the murderer.”³⁵ (This is the reading delivered by his own formal theory.) On the proxy view, this attribution is captured by reading the second conjunct as (24₁).

³⁴ “Pronouns, Quantifiers, and Relative Clauses (I),” p. 111.

³⁵ *Ibid.*, p. 133.

It is (24₂) that Evans finds troubling. As he points out, (24₂) attributes to John the self-contradictory belief that the man who murdered Smith did not murder Smith. The fact that this unlikely reading emerges on the proxy theory suggests to Evans that the correct analysis of descriptive pronouns is that they are rigid designators that have their referents fixed by description, an analysis which prevents them from being interpreted as if they took narrow scope.

There are three points here. First, although Evans claims that E-type pronouns are rigid designators whose references are fixed by description, we must really construe him as making the (“weaker”) claim that they are equivalent to wide-scope descriptions—which is, in fact, the way they are treated in his semantical formalism.³⁶ The reason for this is that being rigid and being equivalent to a description that insists upon wide scope do not amount to the same thing.³⁷ And as Soames points out, typically E-type pronouns are not rigid, because at different circumstances of evaluation the clauses containing their antecedents will be verified by different objects; in which case the pronoun will refer to different objects (or a different object) at different circumstances. Consider (10) again:

(10) John bought *some donkeys* and Harry vaccinated *them*.

If ‘them’ were rigid, it would refer to the donkeys John actually bought—let us say, Eeyore and Dinah—in which case it would be true at any circumstance of evaluation in which Harry vaccinated Eeyore and Dinah as long as John bought some donkeys there, though not necessarily Eeyore and Dinah.

Second, it is not clear that (24) raises a genuine problem for the proxy theorist at all. It is open to argue that the *de dicto* readings of the anaphoric clauses in both (24) and (25) are technically available, but equally unlikely. Third, there are examples of the same general form as (24) in which the *de dicto* reading of the clause containing the anaphoric pronoun is clearly available, if not preferred.³⁸

(26) *A man* murdered Smith. The police have reason to think *he* injured himself in the process.

(27) Hob thinks that *a witch* killed Trigger. He also suspects that *she* blighted Mathilda.

³⁶ This point and the next are made by Soames. At one place Evans does say that “E-type pronouns are like descriptions which insist upon widest scope” [“Pronouns, Quantifiers, and Relative Clauses (I),” p. 132, fn. 67].

³⁷ For discussion, see the 1980 preface to Kripke’s *Naming and Necessity*.

³⁸ Example (26) is from Davies, pp. 172–3. Similar examples can be found in Richards, Wilson, Soames, and Ludlow and Neale.

Similarly where the antecedent is a definite description:

(28) *The inventor of the wheel* was a genius. I suspect *he/she* ate a lot of fish.

(29) I suspect that *the man who murdered Smith* was from out of town.
In fact, I suspect *he* was a foreigner.

To the extent that it makes available *de dicto* readings, the proxy theory must therefore be viewed as superior to Evans's theory, at least for descriptive pronouns in contexts of propositional attitude. To avoid confusion, let us henceforth call pronouns that literally go proxy for definite descriptions D-type (rather than E-type) pronouns.³⁹

What of descriptive anaphors in modal contexts? Are they E-type or D-type pronouns? Consider the following sort of sentence, discussed by Lauri Karttunen:⁴⁰

(30) Mrs Jones wants Mary to marry *a rich man*. *He* must be a banker.

The *de dicto-de dicto* reading of this pair of sentences is perfectly natural. On that reading, the logical form of the antecedent sentence is given by:

(30₁) Mrs Jones wants ([an *x*: man *x* & rich *x*](Mary marry *x*)).

By (P4) the logical form of the antecedent clause is just:

(30₂) [an *x*: man *x* & rich *x*](Mary marry *x*).

If we now apply (P5) to 'he' in the anaphor sentence, that sentence as a whole comes out as either (30₃) or (30₄):

(30₃) [the *x*: man *x* & rich *x* & Mary marry *x*] ■ (banker *x*)

(30₄) ■ [the *x*: man *x* & rich *x* & Mary marry *x*](banker *x*)

³⁹ This terminology is borrowed from Fred Sommers, *The Logic of Natural Language* (New York: Oxford, 1982). Since it is something equivalent to the reading in which the descriptive pronoun has narrow scope that lies beyond Evans's grasp, it will not do to reply on his behalf that the ambiguities in (26)–(29) are due to the fact that the definite and indefinite descriptions they contain are ambiguous between Russellian and referential interpretations. Besides, (a) wide-scope and referential readings of descriptions are not the same thing, (b) descriptive pronouns may take intermediate scope in more complex cases, and (c) Evans himself favors unitary Russellian analyses of definite and indefinite descriptions.

⁴⁰ "Discourse Referents," in James McCawley, ed., *Syntax and Semantics*, vii: *Notes from the Linguistic Underground* (New York: Academic, 1976), pp. 363–385. The example Karttunen actually uses has 'Mary wants to marry a rich man' as its antecedent sentence. I have modified it so as to avoid distracting side issues concerning equi-NP deletion and *de se* attitude reports.

where '■' stands for whatever modal operator is introduced by 'must'. And it is clear that it is (30₄) that is required where the antecedent sentence is read *de dicto*.⁴¹

I shall henceforth assume that all descriptive pronouns are D-type, i.e., that there are no E-type pronouns in natural language.

V. VARIABLE-BINDING AND RELATIVE CLAUSES

Let us return to the pronoun 'it' in (1):

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

As we saw in section I, if the indefinite description 'a donkey' is treated as an existentially quantified noun phrase, then the anaphoric pronoun 'it' cannot be treated as a bound variable. The discussion in section IV provides an explanation of this fact: the indefinite description does not c-command the pronoun (the indefinite is buried inside a restrictive relative clause).

There are three questions before us here: (i) According to the theory of unbound anaphora developed in section IV, is the pronoun 'it' in (1) a genuine D-type anaphor? (ii) If so, does an application of (P5) to that pronoun result in an interpretable reading of (1)? (iii) If so, does the reading delivered by (P5) capture the (Geachian) truth conditions of (1)?

Clearly the answer to (i) is 'yes'. Since the pronoun in question is not c-commanded by its antecedent, by (P2) it cannot be bound, and by (P5) it must receive a descriptive interpretation. Intuitively, we want the sentence to be understood as something like:

- (1₃) *Every man who bought a donkey* vaccinated the donkey *he* bought.

with 'he' bound by 'every man who bought a donkey'. And as we shall now see, this is exactly what a rote application of (P5) delivers.

In the logical notation we have been using, both determiners and quantifiers function as variable-binding operators. A determiner 'Dx' binds any occurrence of *x* in the formula with which it combines to form a restricted quantifier. And a restricted quantifier

⁴¹ The possibility of descriptive pronouns taking narrow scope appears to throw some light on Karttunen's observation that, if the antecedent sentence in (30) is given its *de dicto* reading, the modal auxiliary has to be there for the anaphora to work. Compare (30) with (i): (i) Mrs Jones wants Mary to marry *a rich man*. *He* is a banker. If the antecedent sentence in (i) is read *de re*, there is no problem involved in construing the pronoun in the anaphor sentence as anaphoric on 'a rich man'. But the anaphoric relation is problematic if the antecedent sentence is read *de dicto*. Unpacking the pronoun 'he' in accordance with (P5) yields only one reading for that clause because there is no modal operator with which the description may interact. And on this reading the description will give rise to an implication of existence that will be infelicitous (on Gricean grounds) if the antecedent clause is read *de dicto*.

$\lceil Dx: \phi \rceil$ binds any occurrence of x in the formula with which it combines to form a formula. We can think of relative pronouns that head restrictive relative clauses as variables bound by determiners. For example, we can interpret (31) as (32), and (33) as (34):

- (31) Every man who loves Mary is happy.
 (32) [every x : man x & x loves Mary](x is happy)
 (33) Every man whom Mary loves is happy.
 (34) [every x : man x & Mary loves x](x is happy)⁴²

On the natural assumption that English determiners combine with complex nouns like ‘man who loves Mary’ and ‘man whom Mary loves’, in (31) and (33) the relative pronouns ‘who’ and ‘whom’ are c-commanded by the determiner ‘every’. Consequently, if relative pronouns are treated as variables, we can specify a more general constraint on the operator-variable relationship in English (and perhaps other languages):

- (P6) A variable v is bound by an operator Op only if Op c-commands v .⁴³

On this account, the relative pronoun ‘who’ in our target sentence (1) functions as a variable bound by ‘every’, so the subject noun phrase ‘every man who bought a donkey’ has the logical structure given by (1₄):

- (1) Every man who bought a donkey vaccinated it.
 (1₄) [every x : man x & [a y : donkey y](x bought y)]

Now, what of the pronoun ‘it’ in the verb phrase? Since its antecedent, ‘a donkey’, does not c-command it, by (P2) the pronoun is not a bound anaphor. By (P5), it is therefore a D-type pronoun that goes proxy for a definite description recoverable from the antecedent clause. By (P4), the antecedent clause for the indefinite description ‘a donkey’ is:

- (1₅) [a y : donkey y](x bought y)

⁴² I have made a simplifying assumption here. Following Quine and Evans [“Pronouns, Quantifiers, and Relative Clauses (I)”], it is common to think of relative pronouns as devices of predicate abstraction rather than as genuine variables. On such an account, (31) and (33) are interpreted as (i) and (ii), respectively: (i) [the x : man x & $[\lambda z](z$ loves Mary) x](x is happy); (ii) [the x : man x & $[\lambda z]($ Mary loves z) x](x is happy). In what follows, however, it will do no semantical harm to treat relative pronouns as variables since (i) and (ii) are equivalent to (32) and (34), respectively.

⁴³ With minimal semantical and syntactical assumptions, (P2) follows from (P6).

which contains a free occurrence of x . Applying (P5) to the anaphoric pronoun 'it', we get:

(1₆) [the y : donkey y & x bought y]

which represents the English description 'the donkey he bought'.⁴⁴ Thus, (1) as a whole will be interpreted as either (1₇) or (1₈), according as the subject quantifier or the descriptive pronoun is given wider scope:

(1₇) [every x : man x & [a y : donkey y](x bought y)]

 ([the y : donkey y & x bought y](x vaccinated y))

(1₈) [the y : donkey y & x bought y]

 ([every x : man x & [a y : donkey y](x bought y)](x vaccinated y))

(1₈) is no good because it contains a free occurrence of x . But (1₇) is formally impeccable. It represents the English sentence:

(1₃) *Every man who bought a donkey vaccinated the donkey he bought.*

on the reading on which the pronoun 'he' is interpreted as a variable bound by 'every man who bought a donkey' [the pronoun is c-commanded by the quantifier as (P2) requires].

There is no formal trick here. We have respected (P2) and (P6), used (P4) to determine the anaphoric clause, applied (P5) in a rote fashion, and opted for the reading upon which the descriptive pronoun takes narrow scope.

As it stands, there is an obvious worry about the truth conditions of (1₃). But before examining this worry, let me pause to stress a formal point: the intelligibility of (1₇) refutes Evans's⁴⁵ claim that the anaphoric connection between 'a donkey' and 'it' in (1) precludes a treatment of the subject noun phrase 'every man who bought a donkey' as a restricted quantifier, i.e., as a "logical unit." The theory under consideration—a theory that (a) treats quantified noun phrases in English as restricted quantifiers, and (b) treats unbound

⁴⁴ A theory entertained by Terence Parsons (in "Pronouns as Paraphrases," manuscript, University of Massachusetts at Amherst, 1978) also cashes out the pronoun in terms of such a description.

⁴⁵ "Pronouns, Quantifiers, and Relative Clauses (I)," pp. 136–9; *The Varieties of Reference*, pp. 58–9. A point of clarification is in order here. Geach claims that 'man who bought a donkey', as it occurs in, e.g., 'every man who bought a donkey' is not a logical unit. Evans refutes this claim by constructing a viable semantical theory in which the phrase *is* a logical unit. But then Evans goes on to claim that 'every man who bought a donkey' as it occurs in, e.g., 'every man who bought a donkey vaccinated it' is not a logical unit. And Evans's claim has been refuted in the same way as Geach's, i.e., by the construction of a viable semantical theory in which 'every man who bought a donkey' *is* treated as a logical unit.

pronouns that are anaphoric on quantifiers as definite descriptions—has delivered a perfectly intelligible reading of (1), viz., (1₇). Furthermore, (1₇) is equivalent to the reading that Evans claims his theory delivers for (1). So either both theories provide a correct account of the truth conditions of (1), or neither does: they stand or fall together.⁴⁶

In my opinion, they fall (but not in a way that imperils the view that ‘every man who bought a donkey’ is a logical unit). It is not a consequence of (1) that every man who bought a donkey bought exactly one donkey; but this is a consequence of (1₇) because of the implication of uniqueness built into singular Russellian descriptions. Consequently, the D-type analysis given by (1₇) and the standard analysis given by (1₂):

$$(1_2) (\forall x)(\forall y)((\text{man } x \ \& \ \text{donkey } y \ \& \ x \ \text{bought } y) \supset x \ \text{vaccinated } y)$$

yield divergent truth conditions for (1). In particular, if there is a man who bought two (or more) donkeys and who vaccinated both (or all) of them, (1₇) will be false whereas (1₂) can still be true. I think it must be conceded that this a genuine failing on the part of the D-type analysis as it stands.⁴⁷

A variation of the same problem arises with a D-type analysis of the pronoun in (2):

⁴⁶ Although Evans’s claim is clearly false, there is no quick way to explain exactly where and why his argument breaks down; this is (mainly) because a charitable reconstruction of the argument turns crucially on certain technical details of Evans’s own formal theories of quantification, anaphora, and relative clauses (cf. my “Binary Quantifiers and Unary Quantifier-formers,” forthcoming). For present purposes, the following informal remarks will suffice. The breakdown of Evans’s argument is connected in important ways to (a) his belief that descriptive pronouns cannot take narrow scope and (b) his preference for a “Fregean” interpretation of quantifiers. When certain constraints imposed by his own formal machinery are superimposed on these prior strictures, he is unable to countenance the idea that ‘it’ in (1) is equivalent to a description that takes narrow scope with respect to the quantifier ‘every man who bought a donkey’. At most, Evans could hope to demonstrate that, if one endorsed his view that descriptive pronouns have their references fixed by description, and if one endorsed his “Fregean” interpretation of the quantifiers, then, in order to generate an interpretable reading of (1), one would have to treat ‘every’ as a binary quantifier instead of treating ‘every man who bought a donkey’ as a restricted quantifier. But we have already seen that there are cases in which descriptive pronouns take narrow scope. The upshot of all this is that, rather than provide support for the view that quantified noun phrases cannot be treated as restricted quantifiers, sentence (1) provides further support for the view that descriptive pronouns are D-type rather than E-type anaphors.

⁴⁷ This point is made by Heim, who provides a comprehensive discussion of the most notable attempts to deal with donkey anaphora before presenting her own theory. The same objection to Evans’s theory is made by Richards before he presents his theory. Perhaps the same worry lies behind the failure of Kamp and Barwise to engage Evans’s theory—Kamp makes only one fleeting reference to Evans’s influential work and Barwise does not mention it.

(2) If John buys *a donkey* he vaccinates *it*.

Again, assuming that an indicative conditional like (2) is composed of two sentences and a binary sentential connective, the pronoun 'it' in (2) is a D-type rather than a bound anaphor because it is not c-commanded by its antecedent. A routine application of (P5) delivers:

(2₃) [An x : donkey x](John buys x) \supset

[The x : donkey x & John buys x](John vaccinates x)

which, unlike (2), cannot be true if John buys more than one donkey.

We appear to face a dilemma. The standard Geachian analyses of (1) and (2) provide plausible truth conditions at the expense of an unsatisfactory treatment of indefinite descriptions. The D-type analysis, on the other hand, respects the standard semantics of indefinite descriptions at the expense of unacceptable truth conditions for (1) and (2). In the next section, I shall look at a natural way of repairing the D-type analysis which does not compromise its general appeal.

VI. NUMBERLESS PRONOUNS

Typically, the syntactical number on a bound pronoun agrees with that of its antecedent.⁴⁸ For example, if we use 'all boys' we must use 'they', 'them', 'their', or 'themselves'; if we use 'every boy' we must use 'he', 'him', 'his', or 'himself':

(36) *All boys* respect *their* mothers.

(37) *Every boy* respects *his* mother.

In an introductory logic course, both (36) and (37) might be rendered as:

(38) $(\forall x)(Bx \supset Rx(\iota y)(Myx))$

which makes it clear that whether the pronoun is singular or plural is of no truth-conditional significance; number agreement between antecedent and anaphor is a matter of grammar. Of course, this is a quite general fact about bound anaphora. The variables of quantification theory are unmarked for number (and gender), so if a bound pronoun is to be treated as the natural language counterpart of the logician's bound variable, its overt number will be truth-conditionally inert.

With D-type anaphora matters are more complicated. In the examples we have looked at so far, anaphoric pronouns have agreed in syntactical number with their antecedents. And there has been an implicit assumption that the syntactical number of a D-type pronoun

⁴⁸ There are counterexamples, such as 'Someone has left their copy of the *Phaedo* behind', when uttered in an attempt to avoid using the masculine pronoun.

determines its semantical number. Consequently, unbound pronouns anaphoric on 'just one *F*', 'the *F*', 'some *F*', and 'an *F*', have come out as singular definite descriptions, whereas those anaphoric on 'most *F*s', 'several *F*s', 'the *F*s', 'some *F*s', and 'a few *F*s', have come out as plural descriptions.

But what happens to unbound pronouns that are anaphoric on universally quantified noun phrases? Evans notes that there seems to be a problem with unbound anaphora on 'every'-phrases:

(39) *Every congressman* came to the party. *He* had a marvellous time.

This seems to be unacceptable on the anaphoric reading intended. Evans⁴⁹ offers an explanation in terms of a semantical number clash between antecedent and anaphor: (i) the pronoun is unbound (since its antecedent does not c-command it), therefore (ii) since it is singular, it is interpreted via the singular definite description 'the congressman who came to the party'; yet (iii) the antecedent sentence asserts the existence of a plurality of congressmen who came to the party.

There are problems with this explanation. First, it is not clear that the antecedent sentence in (39) is false if there is only one congressman. We know there are more, and this fact may well affect the way we react to (39). Contrast (39) with (40):

(40) *Every frisbee major* got a job this year. *He* is very happy about it.

Of course, someone who uttered (40) would normally be aiming for some sort of rhetorical effect, but it is clear that the anaphora still works. A partial explanation of the joke-like quality of (40) surely lies in the fact that, if the speaker knows that exactly one person satisfies the descriptive condition expressed by 'frisbee major', typically she will use a definite description like 'the frisbee major' or 'our frisbee major', rather than 'every frisbee major'. It is not that 'every frisbee major' carries with it an implication of plurality, rather it is that it does not carry with it an implication of singularity. (As we shall soon see, the difference is important.)

The second problem with Evans's explanation is that it fails to explain the oddity of (39₁):

(39₁) *Every congressman* came to the party. *They* had a marvellous time.

Perhaps (39₁) is an improvement over (39), but it still seems a little strained. The reason, I suspect, is that in moving from (39) to (39₁) we have traded an alleged clash in semantical number for a very real clash in syntactical number.

⁴⁹ "Pronouns," p. 220.

We are faced here with some quite general questions about number agreement and about cardinality implications present in maximal quantifiers. Recall that D-type anaphora is not always acceptable when the antecedent is of the form 'no F ' or 'no F s':

(41) John bought *no donkeys*. Harry vaccinated *them*.

(42) Every man who bought *no donkeys* vaccinated *them*.

In my opinion, however, it would be a mistake to construct a semantical theory that prevented unbound pronouns from being anaphoric on quantifiers of the form 'no $F(s)$ '. First, an example like the following would be ruled out:

(43) Either there's *no bathroom* in this house or *it's* in a funny place.⁵⁰

Second, the following sentences are just as bad as (41) and (42), but we do not want to prohibit unbound anaphora on indefinite descriptions:

(44) John didn't buy *a donkey* and Harry vaccinated *it*.

(45) Every man who didn't buy *a donkey* vaccinated *it*.⁵¹

The syntactical and semantical rules of the language should not conspire to block (41), (42), (44), and (45): they are perfectly well-formed. The problem is simply that, in the normal course of things, it would make no practical sense to use these sentences. The theory of D-type anaphora explains this. Consider (41); the anaphoric pronoun will come out as 'the donkeys John bought', so the sentence as a whole will be straightforwardly contradictory; similarly for the other examples.

Related considerations apply where the antecedent is a universally quantified noun phrase. In the light of the alleged anaphoric difficulties in (39) and (39₁), and in examples like (46) and (47):

(46) Every man who bought *every donkey* vaccinated *it*.

(47) Every man who bought *every donkey* vaccinated *them*.

some people seem to think that an adequate semantical theory must prevent pronouns from being anaphoric on 'every' phrases that do not c-command them.⁵² In my opinion, this is a mistake. Consider (47). Since this sentence could be true only in a situation in which just one man bought any donkeys, it would certainly be much more natural to say:

⁵⁰ This example is due to Barbara Partee.

⁵¹ Of course, (45) is fine if 'a donkey' is given wide scope, but we are not concerned that readings here (see fn. 6 and fn. 59).

⁵² See, e.g., Hintikka and Carlson, Kamp, and Barwise.

- (48) The man who bought *every donkey* vaccinated *them*.⁵³

And notice that (48) falsifies the view that pronouns anaphoric on 'every' phrases must be c-commanded by them. So do the following:

- (40) *Every frisbee major* got a job this year. *He* is very happy about it.
 (49) Everyone who managed to listen to *every prophet* was asked to rank *them*.
 (50) If John manages to acquire *every Rembrandt* he will build a museum in which to house *them*.

Let us now turn to the matter of semantical number. Even if it is true that phrases of the form 'every *F*' and 'each *F*' have existential import—which is itself open to debate—it is untrue that these quantifiers are always genuinely plural, and untrue that singular unbound pronouns can never be anaphoric on them. Consider the following sentences:

- (51) *Every Swiss male over the age of twenty-one* owns a gun. *He* is required to do so by law.
 (52) *Each candidate* will be debriefed by Mrs Hendrix. *He* will give some advice on how to tackle the press.

But as Evans notes, on the face of it, singular descriptive pronouns seem to carry implications of singularity, and plural descriptive pronouns seem to carry implications of plurality. The upshot of all this is that, in cases where we do not wish to prejudice the issue, we feel uneasy using either. Unbound anaphora on 'every' and 'each' phrases is awkward, however you look at it. To preserve syntactical agreement, a singular pronoun is required; but from a pragmatic standpoint, a plural pronoun will seem more appropriate unless there is doubt (or feigned doubt) as to whether there is more than one *F*. If I am certain that there are several candidates for the new job, I might use (53):

- (53) Mrs Hendrix introduced herself to *every candidate for the new job*. Later she had a reception for *them* over at her house.

But if I know that there is only one candidate, a certain John Jones, I will be inclined to use (53)₁:

⁵³ There are conceivable circumstances in which one might also take utterances of (47) to be making stronger claims. Suppose that Mike bought every donkey on Monday, Tom bought them all from Mike on Tuesday, and Willy bought them all from Tom on Wednesday. The stronger reading I have in mind is the one that is true just in case Mike vaccinated every donkey, Tom vaccinated them, and Willy vaccinated them. (Notice the anaphora in this note.)

- (53₁) Mrs Hendrix introduced herself to *the candidate for the new job*.
 Later she had a reception for *him* over at her house.

For rhetorical effect, however, in certain imaginable situations I might say:

- (53₂) Mrs Hendrix introduced herself to *every candidate for the new job*. Later she had a reception for *him* over at her house.

But what about cases in which we do not want to commit ourselves one way or the other? One interesting idea is that in many such cases unbound anaphoric pronouns go proxy for definite descriptions that are, from a semantical perspective, numberless. The following sentences are surely equivalent:

- (54) Every new recruit is armed.

- (55) All new recruits are armed.⁵⁴

Now suppose we want to continue with a sentence containing an anaphoric pronoun. Preserving syntactical agreement we get the following:

- (54₁) *Every new recruit* is armed. *He* is ready for combat at a moment's notice.

- (55₁) *All new recruits* are armed. *They* are ready for combat at a moment's notice.

Since the pronouns in these pairs are not bound by their antecedents, D-type analyses are called for. But this seems to present a problem. The antecedent sentences in (54₁) and (55₁) are surely truth-conditionally equivalent. But if the subsequent anaphoric pronouns are cashed out as singular and plural definite descriptions, respectively, the two anaphor sentences will not be equivalent. By (P5), the pronoun in (54₁) will come out as 'the new recruit', and the one in (55₁) will come out as 'the new recruits'. And on the analyses of singular and plural descriptions provided earlier, neither of these is right: (54₁) will now be false if there is more than one new recruit, and (55₁) will be false if there is exactly one new recruit. The anaphoric pronouns will have added cardinality implications not supplied by their antecedents. From the point of view of truth conditions, 'every new recruit' and 'all new recruits' are neither singular nor plural, which is why (54) and (55) are equivalent. Following up on a remark made by G. E. Moore, I suggested in section II that

⁵⁴ Similarly for 'Each new recruit is armed'. To say that these sentences are equivalent is not to say that 'every', 'all', and 'each' are "synonymous" in any strong sense. They may have rather different appropriateness conditions; since we are here concerned only with truth conditions, this can be ignored.

phrases like ‘whoever wrote *Waverley*’ and ‘whoever shot John F. Kennedy’ might profitably be viewed as definite descriptions that are semantically numberless. Using $\lceil \text{[whe } x: Fx] \rceil$ to represent a numberless (or neutral) description, the following truth clause was suggested:

(*8) $\lceil \text{[whe } x: Fx](Gx) \rceil$ is true iff $|F - G| = 0$ and $|F| \geq 1$

With a view to honoring the truth-conditional neutrality of their antecedents, we might think of D-type pronouns that are anaphoric on quantifier phrases of the form $\lceil \text{every } F \rceil$, $\lceil \text{all } Fs \rceil$, and $\lceil \text{each } F \rceil$ as semantically numberless.

VII. INDEFINITE DESCRIPTIONS AND NUMBERLESS ANAPHORS

If we take seriously the view that an anaphoric pronoun should not add cardinality implications not already supplied by its antecedent, we should expect to find numberless occurrences elsewhere. On Russell’s account, a sentence of the grammatical form $\lceil \text{An } F \text{ is } G \rceil$ has the same logical form as a sentence of the form $\lceil \text{Some } Fs \text{ are } Gs \rceil$. In the notation of section II, $\lceil \text{[an } x: Fx](Gx) \rceil$ and $\lceil \text{[some } x: Fx](Gx) \rceil$ are logically equivalent; both are true if, and only if, there is at least one F that is G .⁵⁵ On a completely Russellian account of indefinite descriptions, then, since there can be no difference between the truth-conditional contributions of ‘a donkey’ and ‘some donkeys’, the same must be true of the complex noun phrases (i) ‘every man who bought a donkey’ and (ii) ‘every man who bought some donkeys’ (with minimal assumptions concerning compositionality). So in our target sentence (1), we should be able to substitute (ii) for (i) *salva veritate*. But notice that we cannot substitute *salva congruitate*: we must replace ‘it’ with ‘them’ to maintain syntactical agreement between anaphor and antecedent:

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

(1₈) Every man who bought *some donkeys* vaccinated *them*.

Now, if we interpret singular and plural descriptive pronouns as singular and plural descriptions, respectively, not only do we get—as we have already seen—unacceptable truth conditions for (1), we get different truth conditions for (1₈). If ‘them’ is interpreted as ‘the

⁵⁵ In *Introduction to Mathematical Philosophy*, Russell enters the following caveat: “rhetorically there is a difference, because in the one case there is a suggestion of singularity, and in the other case of plurality” (p. 171). Paul Grice’s notion of conventional implicature might be of help in spelling out what Russell has in mind by “rhetorical effect” here. [See H. P. Grice, “Utterer’s Meaning, Sentence Meaning, and Word Meaning,” *Foundations of Language*, IV, 3 (1968): 225–242.] It is, of course, open to challenge Russell on the truth-conditional equivalence of $\lceil \text{An } F \text{ is } G \rceil$ and $\lceil \text{Some } Fs \text{ are } Gs \rceil$ (see below).

donkeys he bought', (1₈) will be false if every man who bought a donkey bought just one donkey.⁵⁶ To the (complete) Russellian, this divergence might suggest that we pursue the suggestion, made in passing by Terence Parsons and by Martin Davies,⁵⁷ that descriptive pronouns anaphoric on indefinite descriptions are, or at least can be, interpreted as numberless descriptions. After all, independent evidence for the existence of such pronouns has already been provided. On such an account, the logical forms of (1) and (1₈) will be (1₉) and (1₁₀), respectively:

(1₉) [every x : man x & [a y : donkey y](x bought y)]

[whe y : donkey y & x bought y](x vaccinated y)

(1₁₀) [every x : man x & [some y : donkeys y](x bought y)]

[whe y : donkey y & x bought y](x vaccinated y)

On Russell's assumption that $\lceil [a y: Fy](Gy) \rceil$ and $\lceil [some y: Fy](Gy) \rceil$ are equivalent, (1₉) and (1₁₀) are also equivalent. Moreover, (1₉) gives us the right truth conditions for (1), viz., those given by Geach. So it does seem to be possible to provide an analysis of (1) that delivers the correct (Geachian) truth conditions and honors a Russellian treatment of singular indefinite descriptions. The "universalization" of the indefinite description 'a donkey' in (1) is a logical illusion: it is the pronoun that has universal force, by virtue of standing in for a definite description.

Let us look at some possible objections to this proposal. First, it might be objected that (1) and (1₈) have different truth conditions, that even if (1₉) captures the force of (1), (1₁₀) misrepresents the force of (1₈), the truth of which does not depend on how things are with any man who bought only one donkey. But this is not really an objection to the proposed treatment of the pronoun in (1₈), nor to Russell's treatment of singular indefinites; it is an objection to Russell's treatment of plural indefinites. The objector is contesting Russell's claim that $\lceil An F is G \rceil$ and $\lceil Some Fs are Gs \rceil$ are equivalent. In short, the objector is urging the following split:

(*4) $\lceil An F is G \rceil$ is true iff $|F \cap G| \geq 1$

(*9) $\lceil Some Fs are Gs \rceil$ is true iff $|F \cap G| > 1$

I am inclined to agree. But analyzing plural indefinites in this way

⁵⁶ Similarly for the following pair: (i) If John buys *a donkey* he vaccinates *it*; (ii) If John buys *some donkeys* he vaccinates *them*.

⁵⁷ See Parsons, p. 20, and Davies, p. 175. (I am grateful to Higginbotham for directing my attention to the former reference and to Davies for directing my attention to the latter.) Richards (p. 294) seems to be on the verge of making a similar suggestion.

does not create a problem for the pronominal theory under consideration. If (*9) is adopted, the relevant difference in truth conditions between (1) and (1₈) will follow as a consequence of distinct treatments of the antecedents 'a donkey' and 'some donkeys' (rather than distinct treatments of the anaphors 'it' and 'them'). Second, it might be suggested that the numberless proposal cannot be correct because some pronouns anaphoric on singular indefinite descriptions are semantically singular. After all, in section IV we looked at some examples in which analyses of such pronouns as singular descriptions seemed to be appropriate.

There are several things one might say in response to this. First, one might maintain that, as a matter of fact, some D-type pronouns anaphoric on singular indefinites are singular while others are numberless. This would not, of course, be to abandon the spirit of the theory of D-type anaphora, it would simply be to bestow upon it a welcome degree of flexibility. The line of reasoning here would be as follows. When one uses a sentence of the form 'An *F* is *G*', very often some singular belief or other furnishes the grounds for one's utterance, and a subsequent pronoun anaphoric on the indefinite will, in all probability, be interpreted as semantically singular. But if the indefinite description is within the scope of, say, a universal quantifier, very likely the speaker has general grounds for his assertion. In which case he is less likely to want to be committed to any implication of (relative) uniqueness. Consequently, if we are not to complicate the language by adding a new numberless pronoun, we must allow for the possibility of a numberless interpretation of 'it' in cases where the antecedent does not force a singular interpretation, i.e., where the antecedent is genuinely numberless.

And it is clear that singular indefinites themselves are genuinely numberless. Compare (*4) and (*5) above with (*6) and (*7):

(*6) 'The *F* is *G*' is true iff $|F \cap G| = 1$ and $|F - G| = 0$

(*7) 'The *F*s are *G*s' is true iff $|F \cap G| > 1$ and $|F - G| = 0$

The truth of 'the *F* is *G*' requires that $|F \cap G| = 1$ and the truth of 'the *F*s are *G*s' requires that $|F \cap G| > 1$, so these sentences can never be true together.⁵⁸ But singular indefinite descriptions are not semantically singular, they do not generate uniqueness implications. When we just wish to say that $|F \cap G| = 1$, we say 'Exactly one *F* is *G*', or 'Just one *F* is *G*'. The truth of 'An *F* is *G*' does not require that $|F \cap G| = 1$, it just requires that $|F \cap G| \geq 1$, and this is

⁵⁸ If $|F - G| = 0$, clearly $|F| = |F \cap G|$. I have used ' $|F \cap G|$ ' rather than ' $|F|$ ' in these restatements of (*6) and (*7) only to bring out the relationship between definite and indefinite descriptions.

perfectly consistent with the truth of 'Some *Fs* are *Gs*', even on the non-Russellian analysis of plural indefinites given in (*9). In short, singular indefinites are not semantically singular.

Now, according to the proposal under consideration, a pronoun anaphoric on a singular indefinite occurs in the singular so as to maintain syntactical agreement. At this stage we may proceed in one of two directions. One option, of course, is to say that the pronoun has to be interpreted as a numberless description so as not to add any cardinality implication to the truth conditions not already supplied by its antecedent. The other option is to say that the pronoun may be either singular or numberless depending upon various contextual or linguistic factors. In view of the fact that informants have insecure and divergent intuitions when questioned about the truth conditions and/or grammaticality of many donkey sentences—see especially some of those listed below—I am inclined to think that the flexibility introduced by the latter option is called for. Compare the following:

- (1) Every man who bought *a donkey* vaccinated *it*.
- (57) Every man who has *a daughter* thinks *she* is the most beautiful girl in the world.
- (58) Some man who bought *a donkey* vaccinated *it*.
- (59) Some men who bought *a donkey* vaccinated *it*.
- (60) Most men who bought *a donkey* vaccinated *it*.

As we have already seen, in (1) the numberless interpretation of the pronoun seems to be preferred. But as Parsons points out, in an example like (57)—which is of the same general form as (1)—a singular interpretation of the pronoun seems to be preferred. A reasonable explanation is that immediate linguistic context, and lexical and background knowledge, conspire to defeat the numberless interpretation (in the normal run of things, there cannot be two most beautiful girls in the world).

In (58) and (59), there is no obvious reason to prefer either interpretation, but the singular interpretation is apparently preferred; perhaps it is the default interpretation.⁵⁹ In (60) the numberless interpretation is preferred, probably for the same sorts of reasons it is preferred in (1).⁶⁰

⁵⁹ The reading in which 'a donkey' takes wide scope and binds 'it' is also available for many speakers. [As mentioned earlier, sentence (1) also seems to admit of a reading in which 'a donkey' takes wide scope.] The existence of such readings seems to provide support for the view that there is a level of syntactical representation at which scope assignments have been made and at which (P2) holds.

⁶⁰ We can represent the logical form of (60) as: (i) [most *x*: men *x* & [a *y*: donkey *y*](*x* buys *y*)]([whe *y*: donkey *y* & *x* buys *y*](*x* vaccinates *y*)). This captures the

Sentence (61) provides very strong evidence for numberless D-type pronouns:

(61) Every man who bought *a beer* bought five others along with *it*.

If the pronoun 'it' is interpreted as a singular description then the

preferred truth conditions, on the assumption that (*5) is an adequate truth clause for 'most *Fs* are *Gs*': (*5) $\lceil \text{[most } x: Fx](Gx) \rceil$ is true iff $|F \cap G| > |F - G|$. [Some informants get additional readings of (60), viz., one that requires that most men who bought at least one donkey vaccinated at least one of the donkeys they (qua individuals) bought, or another that requires that most men who bought at least one donkey vaccinated most of the donkeys they (qua individuals) bought.]

This is a good point to bring out the main differences between the theory of D-type anaphora and the theories of "discourse representation" (DR) proposed by Kamp and Heim, both of whom reject Russell's analyses of definite and indefinite descriptions as well as descriptive approaches to unbound anaphora. There are some differences between Kamp's theory and Heim's theory, but we can, I think, put these aside for present concerns. Two ideas stand out: (a) definite and indefinite descriptions introduce variables rather than quantifiers; (b) a quantified sentence $\lceil [Dx: \phi](\psi) \rceil$ is true if and only if *D* assignments of values to free variables in ϕ that satisfy ϕ also satisfy ψ . [As Heim stresses, this idea has its origins in one of the central proposals in David Lewis's "Adverbs of Quantification," in E. Keenan, ed., *Formal Semantics of Natural Language* (New York: Cambridge), pp. 3–15. The similarities show up especially in the analysis of conditional donkey sentences.] On this account, our target sentence (1) is true if and only if every assignment of values to *x* and *y* that satisfies (ii) also satisfies (iii): (ii) man *x* & donkey *y* & *x* bought *y*; (iii) *x* vaccinates *y*. Thus, the DR theory and the D-type theory (that allows number-neutral pronouns) deliver equivalent analyses of (1). But the ways in which these two theories achieve this result are, of course, rather different: the theory of D-type anaphora locates the implication of maximality in (1) in the anaphoric pronoun, whereas DR theory locates it in the determiner 'every'. Example (60), brings out this difference very clearly. On the DR proposal, (60) is true if and only if most assignments of values to *x* and *y* that satisfy (ii) also satisfy (iii). And as Richards (p. 281) points out, this is incorrect: suppose Alan bought ninety donkeys, and five other men bought exactly two donkeys each. DR theory predicts that (60) is true if Alan vaccinated fifty one or more of the donkeys he bought and the other five men failed to vaccinate any of their donkeys.

The problem here is that in (60) 'most' is quantifying over donkey-buying men and not over pairs of donkey-buying men and donkeys, as DR theory requires. This suggests that the success this approach has with capturing the implication of maximality in (1) is due to an artifact of first-order logic, and that it will need to be supplemented by some additional machinery if it is to handle the full range of examples. Whereas (60) seems to favor the D-type over the DR approach, it is arguable that (iv) provides evidence the other way (though this will ultimately depend upon one's final analyses of nonsingular descriptions and monotone decreasing quantifiers): (iv) No man who bought *a donkey* vaccinated *it*. On the DR proposal, (iv) is true just in case no man who bought a donkey vaccinated any of the donkeys he bought, which seems to me like the preferred reading. On the D-type proposal, if the pronoun goes proxy for the singular description 'the donkey he bought', we get a less desirable reading with an implication of relative uniqueness. If it goes proxy for a numberless description we get a reading equivalent to 'No man who bought a donkey vaccinated each of the donkeys he bought', which does not seem like a genuine reading of (iv). As Irene Heim has pointed out to me, (iv) does not actually pose a problem for the view that the pronoun goes proxy for a numberless description—on its preferred reading, (iv) can be paraphrased as 'No man who

sentence will be automatically false.⁶¹ But if it is interpreted as a numberless description, things come out exactly right: the sentence will be true just in case every man who bought at least one beer bought five other beers along with each of the beers he bought.⁶²

Further evidence for semantically numberless pronouns comes from sentences like the following:

(62) Every man who bought *a donkey and a mule* vaccinated *them*.

(63) Every man who bought *a donkey or a mule* vaccinated *it*.

bought a donkey vaccinated the donkey or donkeys he bought'—rather it poses a more general problem concerning the interpretation of nonsingular definite descriptions within the scope of monotone decreasing quantifiers. The following examples bear out Heim's point: (v) *No man* vaccinated the donkeys *he* bought; (vi) *Few men* vaccinated the donkeys *they* bought. Again, the descriptions are naturally interpreted as 'any of the donkeys he (they) bought' rather than 'each of the donkeys he (they) bought'.

The situation, then, seems to be as follows: (a) DR theory has problems with a sentence like (60), in which the indefinite description is within the scope of a non-first-order determiner such as 'most'; (b) if the D-type theory utilizes the standard distributive analysis of plural and numberless descriptions, then it will have a problem with a sentence like (iv), in which the indefinite description is within the scope of a monotone decreasing determiner like 'no'. Consequently, if we use a determiner like 'few', which is both monotone decreasing and non-first-order, we can construct a sentence that may be problematic for both approaches: (vii) *Few men* who bought *a donkey* vaccinated *it*. A further difference between the D-type and DR approaches is that the latter, along with the theories proposed by Hintikka and Carlson and by Barwise, explicitly prohibits the anaphoric relations in sentences where the antecedent is of the form \lceil every F \rceil —e.g., (48)–(52)—because 'every' phrases are genuine quantifiers (rather than referring expressions or devices that simply introduce variables).

In this note, I am indebted to discussion with Irene Heim.

⁶¹ The problem for Evans posed by sentences like (61) was pointed out by Heim and by Ernest Le Pore and James Garson in "Pronouns and Quantifier-Scope in English," *Journal of Philosophical Logic*, xii, 4 (1983): 327–358.

⁶² A numberless analysis of the pronoun 'it' in (61) does not mean that the sentence cannot be true unless every man who bought a beer bought eleven beers; nor does it mean that the sentence cannot be true unless every man who bought a beer bought an infinite number of beers (in discussion periods, it has more than once been claimed that the numberless analysis makes one or other of these undesirable predictions). As I mentioned earlier, I am confining my talk about plural and numberless descriptions to cases in which they receive distributive readings. This is reflected in the truth clauses (*7) and (*8). It is well-known that many plural noun phrases may be interpreted collectively when combined with the right predicates; and, naturally enough, this includes plural descriptions ('The donkeys pulled Pedro's cart up the hill') and plural descriptive pronouns ('*The men* hauled Bill's Piano down the stairs; then *they* loaded it into a truck'). It is, of course, the simple distributive reading of the numberless descriptive pronoun 'it' in (61) that we are interested in. Confused talk of men buying eleven (or an infinite number of) beers results from thinking that nonsingular descriptive pronouns have to be interpreted collectively even though nonsingular descriptions do not. I suspect that the origin of this confusion lies in popular but loose talk of plural E-type pronouns as referring to "sets," "classes," "maximal collections," and the like. Evans himself says nothing that commits him to just collective readings of nonsingular E-type pronouns, and for good reason.

(64) Every man who bought *more than one donkey* vaccinated *it*.

(65) Every man who bought *two or more donkeys* vaccinated *them*.

In (62), the pronoun appears to be going proxy for the conjunctive description ‘the donkey(s) he bought and the mule(s) he bought’, which is syntactically plural as well as semantically plural (given the semantics of conjunction), so ‘them’ is the correct choice. In (63), the pronoun appears to be going proxy for ‘the donkey(s) he bought or the mule(s) he bought’. The semantics of disjunction requires that, for (63) to be true, every man who bought a donkey vaccinated it, every man who bought a mule vaccinated it, and every man who bought a mule and a donkey vaccinated them; hence the pronoun seems to demand a numberless interpretation. (This suggests, perhaps, that when a numberless interpretation is required and there is no syntactical reason to use a plural pronoun, it is the singular pronoun that is called upon.)

Many speakers find (64) and (65) truth-conditionally equivalent. But notice that in (64), the pronoun is syntactically singular so as to agree with ‘more than one donkey’, even though it cannot be interpreted as semantically singular for fear of contradiction.

It seems to be clear, then, that donkey anaphora of the sort exemplified in sentences of this general form—i.e., where the antecedent is a constituent of a relative clause—does not by itself undermine either a unitary Russellian analysis of indefinite descriptions or a D-type analysis of unbound anaphora. The maximality implication that (1) apparently gives rise to can be captured once it is seen that D-type pronouns anaphoric on numberless antecedents may, and in some cases must, receive numberless interpretations, and that agreement between anaphors and antecedent noun phrases is, by and large, a syntactical matter.

Virtually everything that has just been said carries over *mutatis mutandis* to conditional donkey sentences. Notoriously, conditionals give rise to all sorts of problems in philosophical logic, and it is with great trepidation that I bring them up at all. It is worth remarking, however, that, under the present proposal, anaphoric relations in conditionals do not appear to raise any new or additional problems. Indeed, the proposal seems to help with some old ones. Consider (2):

(2) If John buys *a donkey* he vaccinates *it*.

The truth conditions of (2) are apparently captured by (2₃), a fact that allegedly commits us to a wide-scope universal rather than a narrow-scope existential treatment of the indefinite description:

(2₃) [Every x : donkey x](John buys $x \supset$ John vaccinates x)

But we can now provide a coherent account of (2) that comports with the existential analysis of the indefinite. On the assumption that a

conditional is composed of two sentences and a binary sentential connective, the pronoun 'it' in (2) is not a bound anaphor because it is not c-commanded by its antecedent. So on the numberless D-type proposal, (2) will come out as (2₄):

- (2₄) [an x : donkey x](John buys x) \supset
 [whe x : donkey x & John buys x](John vaccinates x)

which does not seem to invite any objection (over and above those standardly brought up against the material conditional). It would seem, then, that we are not forced to treat indefinite descriptions in the antecedents of conditionals as universally quantified expressions that mysteriously take wide scope.

This is a good point at which to say something about quantifiers of the form \ulcorner any F \urcorner . It is sometimes claimed that quantifiers of this form are special in that they appear to insist on wide scope in certain environments.⁶³ In particular, it is sometimes argued that the scope of an occurrence of \ulcorner any F \urcorner in the antecedent of a conditional extends to the consequent. Consider the following example (from Chrysippus):

- (66) If *any man* was born at the rising of the dog-star, *he* will not die at sea.⁶⁴

By treating 'any man' as a universally quantified expression with wide scope over the entire conditional, and by treating 'he' as a bound variable, one can capture the force of (66) with (66₁):

- (66₁) [Every x : man x]
 (x was born at the rising of the dog-star \supset x will not die at sea)

But this is thoroughly unilluminating; it forces us to attribute to \ulcorner any F \urcorner properties that other quantifiers simply do not possess, viz., the capacity to take scope over a conditional when embedded in its antecedent.

Under the D-type proposal, we no longer need to treat 'any' as exceptional. On the assumption that (a) it receives its existential reading in (66), and (b) its scope is restricted to the antecedent of the conditional (i.e., everything it c-commands), the pronoun 'he' is a D-type anaphor and comes out as a numberless description, which gives us the following:

- (66₂) [any x : man x](x was born at the rising of the dog-star) \supset
 [whe x : man x & x was born at the rising of the dog-star](x will not die at sea)

⁶³ See, e.g., Hornstein. Evans [\ulcorner Pronouns, Quantifiers, and Relative Clauses (I) \urcorner] also expresses some sympathy for this view.

⁶⁴ The example is taken from Cicero, *De Fato*, VI, in *Libri De Divinatione et De Fato* (Cambridge: Knapton, Knaplock, & Vaillant, 1721), pp. 311–2.

I should finally say something about how the present proposal handles the following example, which has been regarded as presenting insurmountable problems for descriptive approaches to unbound anaphora:

- (67) If a man shares an apartment with another man, he also shares the housework with him.⁶⁵

If the pronoun 'he' goes proxy for a singular description, the nature of the problem is clear: there is no unique man who shares an apartment with another man. For suppose *b* is such a man; then there is a distinct man *c* with whom *b* shares an apartment. But *sharing an apartment with* is symmetric, therefore *c* is also a man who shares an apartment with another man, viz., *b*.⁶⁶

But now suppose the pronoun 'he' goes proxy for a numberless description. In order that we do not get swamped with quantifiers, let us use *P* as shorthand for the two-place predicate 'shares an apartment with', and *R* as shorthand for the two-place predicate 'shares the housework with'. The logical form of the antecedent of the conditional (67) is given by:

- (67₁) [an *x*: man *x*]([a *y*: man *y* & *y* ≠ *x*](*Pxy*))

By (P4) this also represents the antecedent clause for 'a man'. If we apply (P5) to the pronoun 'he' (in the consequent) we get:

- (67₂) [whe *x*: man *x* & [a *y*: man *y* & *y* ≠ *x*](*Pxy*)]

By (P4) the antecedent clause for 'another man' is:

- (67₃) [a *y*: man *y* & *y* ≠ *x*](*Pxy*)

If we apply (P5) to the pronoun 'him' we get:

- (67₄) [whe *y*: man *y* & *y* ≠ *x* & *Pxy*]

Combining these descriptions with the matrix clause *Rxy*, the consequent of (67) comes out as:

- (67₅) [whe *x*: man *x* & [a *y*: man *y* & *y* ≠ *x*](*Pxy*)]

- ([whe *y*: man *y* & *y* ≠ *x* & *Pxy*](*Rxy*))

which says that every man who shares an apartment with another man shares the housework with every other man with whom he shares an apartment; and this is exactly what we want. Sentence (67) would therefore seem to provide very strong evidence for the view

⁶⁵ This particular example is due to Heim.

⁶⁶ The special feature of this example is that it resists attempts to secure uniqueness by appealing to an implicit event (or situation) parameter: there is no event (or situation) in which a unique man shares an apartment with another man.

that D-type pronouns anaphoric on singular indefinite descriptions can be numberless.⁶⁷

VIII. CONCLUSION

I have attempted to defend the view that the existence of donkey anaphora—indeed, unbound anaphora more generally—does not force us to abandon traditional accounts of quantification and anaphora. As Evans has demonstrated, pronouns anaphoric on quantifiers must stand in a particular syntactical relationship to those quantifiers if they are to be interpreted as bound variables. Those which do not stand in this relationship—essentially, those which are not constituents of the smallest clauses containing their antecedents—are plausibly interpreted as definite descriptions.

I have advocated three departures from Evans's theory. (i) With a view to preserving the syntactical and semantical unity of quantified noun phrases, I have treated such phrases as restricted quantifiers (rather than treat determiners as binary quantifiers). (ii) On Evans's account, descriptive pronouns are rigid designators whose referents are fixed by description. But there is clear evidence that descriptive pronouns may enter into scope interactions in much the same way as overt descriptions; consequently, I have treated such pronouns as going proxy for descriptions.⁶⁸ On such an account, the donkey pronoun in (1) goes proxy for a description that may take narrow scope with respect to the subject quantifier. The syntactical and semantical details of the theory now allow us to treat both the subject quantifier and the descriptive pronoun as restricted quantifiers, contrary to Evans's claims. (iii) Since certain quantifier phrases (including many universally quantified noun phrases and singular indefinite descriptions) are truth-conditionally numberless, it is natural to allow for the possibility that (at least some) occurrences of pronouns anaphoric on such quantifiers respect this number neutrality, agreement between anaphors and antecedents being essentially a syntactical matter. Sentence (1) is a case in point.

I hope I have, at least for now, made a plausible case for the view that the examples considered in this paper do not undermine (a) a unitary existential analysis of indefinite descriptions, (b) an account of quantified noun phrases as restricted quantifiers, or (c) a descriptive analysis of unbound anaphora.

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⁶⁷ Examples involving two or more D-type pronouns bring up other complex issues that are discussed in my *Descriptions*, chs. 5–6.

⁶⁸ A residual question here is whether there is a level of syntactical description at which the description appears.