

Chapter 4

Pronouns as Bound Variables

In chapter 2 of this study we reviewed some of the literature on donkey anaphora. We found that besides presenting difficulties of a semantic nature, donkey sentences raise questions of scope and binding, which we believe to be governed by principles of syntax. In chapter 3 we developed a syntactic theory of scope assignment which allowed us to account for the scopal peculiarities of weak NPs in general. In the present chapter, we shall attempt to extend our Scope Assignment analysis of relative scope phenomena to questions of bound anaphora. In section 4.1., we shall address the syntactic licensing of regular bound variable pronouns. In sections 4.2. and 4.3., we shall consider the scopal and interpretive properties of donkey antecedents and the licensing of donkey anaphors, from a Scope Marking perspective.

4.1. Bound Variable Pronouns

In chapter 2, we very briefly discussed the syntactic conditions on the licensing of bound variable pronouns. In the following subsections, we will review a range of hypotheses that have been put forward to deal with these conditions. While each of the accounts to be discussed below correctly predicts the basic weak crossover data, some fail to account for a number of exceptional cases of bound variable anaphora, and some fail to do so, I believe, in a sufficiently principled manner. As we shall see, some authors have attempted to incorporate the conditions on variable binding into the theory of A-binding as developed in Chomsky (1981), (1982); we will argue that this is undesirable. Finally, in section 4.1.8., we shall present a proposal based on the theory of Scope Marking developed in the previous chapter. We shall not, at this point, discuss the binding properties of donkey anaphors, but turn to these in section 4.3..

4.1.1. Chomsky (1977a)

Consider first some examples of strong crossover, in (1).

- (1) a. * who_i does he_i like t_i
 b. * everyone_i he_i likes t_i
 c. * he_i likes everyone_i
- (2) * he_i likes John_i

In (1a) the pronoun cannot be interpreted as a variable bound by *who*; this sentence

cannot mean: "for which person x , x likes x " (Cf. Postal 1971, Wasow 1972). The bound reading is also absent in (1c); it cannot mean: "for every person x , x likes x ". Chomsky (1977a) took the parallelism between (1a) and (1c) as an indication that the S-Structure (1c) is mapped onto an LF-representation as in (1b), which is structurally similar to (1a). Noting further the parallelism between (1) and (2), Chomsky proposed that the trace in object position in (1) is a name-like element comparable to *John* in (2). Within the framework of Chomsky (1981), these examples are generally regarded as violations of binding condition C. Both in (1a) and in (1b), the moved element occupies an A-bar position, hence its trace is a variable; the variable being A-bound by the pronoun violates condition C (or, if the Binding Conditions are taken to apply only at S-Structure, the QNP in (1c) itself is an improperly A-bound R-expression).

Now consider some examples of weak crossover (repeated from chapter 2).

- (3) a. * who_i does his_i mother like t_i
 b. * everyone_i his_i mother likes t_i
 c. * his_i mother likes everyone_i

- (4) \checkmark his_i mother likes John_i

In (3) the absence of the intended readings cannot be attributed to principle C, since the variables left by the moved elements are not c-commanded, hence not bound by the coindexed pronouns. This is confirmed by the well-formedness of (4). Chomsky (1977a) proposed the following condition to account for weak crossover.

- (5) A variable cannot be the antecedent of a pronoun to its left.
 (= Chomsky 1977a:(105))

This condition has been dubbed the Leftness Condition by Higginbotham (1980a), and we shall refer to it as such below. We can understand it as excluding the intended readings of (3a & b) on the grounds that the pronouns in these examples are to the left of the traces left by the operators. Note that for this account to go through we must take seriously the notion that the variable that interprets the trace must act as an antecedent to the pronoun, which can then act as an anaphor that is assigned any value assigned to the variable. The operator itself cannot be the antecedent, in this sense, since it is not assigned any referential values. The need for these assumptions is obviated by Chomsky's later reformulation of the Leftness Condition, which we give in (6).

- (6) "...a pronoun P within the scope of a quantifier may be rewritten as the variable bound by this quantifier unless P is to the left of an occurrence of a variable already bound by this quantifier."
 [Chomsky 1977a:202]

The Leftness Condition as given in (6) also includes a second condition on bound variable pronouns: a bound variable pronoun must be within the scope of its operator. This condition has been stated by Koopman & Sportiche (1982) as their Scope Condition; we shall use this term below. The Scope Condition accounts for the contrast between (7) and (8).

- (7) a. every soldier_i has his_i orders
 b. every soldier_i t_i has his_i orders
- (8) a. * [every soldier_i is armed], but will he_i shoot
 b. * [every soldier_i t_i is armed], but will he_i shoot

In the LFs for (7a) and (8a) (given in (7b) and (8b)) the pronoun is to the right of the trace, in compliance with the Leftness Condition. Nevertheless, (8a) does not allow a bound variable reading for the pronoun. The explanation is that in (8b) the pronoun is not in the scope of *every soldier*.

Chomsky assumed the Scope Condition to be a rule of sentence grammar, one of his rules of semantic interpretation SI-1, which map S-Structure onto LF, rather than one of his rules of semantic interpretation SI-2, which operate on LF (and possibly on other cognitive representations) to derive a semantic representation (comparable to what we have been calling LF' here). He did not provide any direct evidence to support this assumption, however, and it seems to me that we might as well assume that it is a property of SI-2 (or of the semantic representations they derive) that a variable can be bound by an operator that has scope over it, and will be a free variable otherwise. We can then make further assumptions regarding the status of free variables, taking them to function referentially, in some sense, or perhaps ruling out any semantic representations that contain them. I do not know of any evidence that might decide this question, and will leave the matter open here.

As for the Leftness Condition, much empirical evidence against the directionality approach to variable binding (or to (binding) phenomena in general; see e.g. Reinhart (1978)) has been put forward in the literature. For instance, Koopman & Sportiche (1982) point out that by the Leftness Condition, (9a) should be more acceptable than (9b), which it is not.

- (9) a. * who_i did you give a picture of t_i to him_i
 b. * who_i did you give a picture of him_i to t_i

Below, we shall discuss other examples which argue against the Leftness Condition as a constraint on bound variable pronouns; we shall be concerned mainly with weak crossover cases, accepting Chomsky's (1981) Condition C account of strong crossover phenomena.

4.1.2. Higginbotham (1980a), (1980b), (1983)

Higginbotham (1980a), working within the "On Binding" framework (Cf. Chomsky 1980), notes the following exception to the Leftness Condition.

- (10) a. some musician_i will play [every piece you want him_i to]_j
 b. some musician_i t_i will play [every piece you want him_i to]_j
 c. some musician_i [every piece you want him_i to]_j t_i will play t_j

(10a) has the bound reading for the pronoun, although its Logical Form (10c) has the pronoun to the left of the variable, in violation of the Leftness Condition (the problem disappears, of course, if we allow the object to adjoin to VP instead of S (Cf. Koopman & Sportiche 1982, Chomsky 1986a:6)). Higginbotham concludes that the Leftness Condition must be reformulated as a condition on rule application, rather than a condition on LF representations: although the pronoun is not appropriately to the right of a variable in either the SS (10a) or in the LF (10c), it is in the intermediate representation (10b), after QR of the subject. Higginbotham reformulates the Leftness Condition as a condition on coindexing (which is an anywhere-rule) roughly as follows.

- (11) j may become i, in a configuration [e_i pro_j]

Order in (11) is relevant: it says that a pronoun *pro* may be coindexed with a variable *e* only if the variable is to the left of the pronoun. However, Higginbotham notes some further exceptions to the Leftness Condition in either formulation. Consider first (12).

- (12) a. * its_i climate annoys [someone in every city_i]_j
 b. * every city_i [someone in t_i]_j its_i climate annoys t_j

In (12a) the pronoun may not be interpreted as indicated, although the LF representation in (12b) complies with the Leftness Condition since the variable *t_i* is to the left of the pronoun. Similar examples may be constructed with Wh-operators; Higginbotham (who aims at a unification of weak and strong crossover as Leftness Condition effects) provides the strong crossover example in (13a). A weak crossover case is given in (14).

- (13) a. * [which picture of which man_i]_j does he_i like t_j
 b. * which man_i [which picture of t_i]_j does he_i like t_j

- (14) a. * [which picture of which man_i]_j does his_i mother like t_j
 b. * which man_i [which picture of t_i]_j does his_i mother like t_j

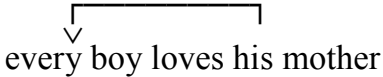
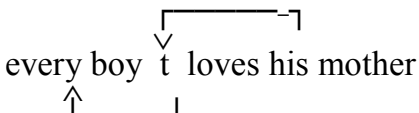
In (13a) and (14a), which are represented at LF as (13b) and (14b) respectively, the pronouns may not be interpreted as bound variables, although the Leftness Condition is satisfied in both cases. It appears from these facts that the Leftness Condition as an approach to crossover is too weak as stated, since it does not account for the 'transitivity' of the crossover effect observed here. Higginbotham (1980a) attempted to remedy this shortcoming by means of an additional constraint on crossover, the C-constraint formulated in (15).

- (15) C-constraint (Cf. Higginbotham 1980a:693)
 pronoun_j cannot reindex to *i* if this results in a configuration of the form:
 $\dots (\dots e_i \dots)_k \dots \text{pronoun}_i \dots e_k \dots$

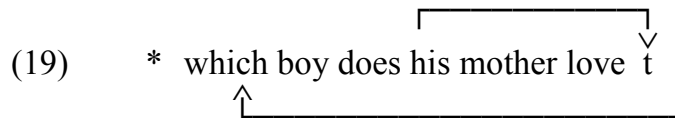
This constraint, besides pointing up the basic insufficiency of the Leftness Condition, which was itself intended to account for crossover effects, is again not general enough, as pointed out by Higginbotham (1980b). It accounts for the transitivity of crossover only 'one level down', hence it does not account for more deeply embedded crossing antecedents, as in (16) (= Higginbotham 1980b:(21)) or (17).

- (16) a. * [which picture of [which daughter of which man_i]_j]_k does he_i like *t_k*
 b. * which man_i [which daughter of *t_i*]_j [which picture of *t_j*]_k does he_i like *t_k*
- (17) a. * [which picture of [which daughter of which man_i]_j]_k does his_i mother like *t_k*
 b. * which man_i [which daughter of *t_i*]_j [which picture of *t_j*]_k does his_i mother like *t_k*

Higginbotham (1980b) and (1983), having adopted the GB framework, traded in the Leftness Condition for an account in terms of c-command, augmented with a device for capturing the transitivity effects involved in variable binding phenomena. We shall concentrate here on the proposal as outlined in Higginbotham (1983). Here, coindexing is not subject to conditions on application; instead, A-positions may be freely 'linked' at S-Structure, and linking applies by convention between a moved constituent and its trace. Thus, (18a) will have the LF (18b).

- (18) a. 
 every boy loves his mother
- b. 
 every boy *t* loves his mother

In (18a), the pronoun is linked to the A-position occupied by *every boy*. At LF, the pronoun remains linked to this position, now occupied by a variable which in turn is linked, by convention, to the A-bar operator. The pronoun in (18b) is now said to be 'dependent' upon the variable. The effects of the Leftness Condition are captured partly by the stipulation that linking can only obtain between A-positions at S-Structure; this implies that the pronoun cannot be linked to the operator directly in (18b), or in (19) for example.



Consequently, a pronoun interpreted as a variable bound by a (moved) operator will always be dependent upon some variable. A further condition requires that this variable either have c-command over the pronoun (which it does in (18b), but not in (19), hence its ill-formedness), or, to account for transitivity cases, be contained in an operator whose variable obeys this condition. Higginbotham first defines a V-chain as any sequence (v_1, \dots, v_n) of variables where each variable $v_i < v_n$ is contained in the binder of v_{i+1} . He then postulates that a pronoun which is dependent upon a variable v must be accessible to v , where a pronoun is accessible to a variable v_1 , if v_1 heads the V-chain (v_1, \dots, v_n) which is the maximal V-chain such that the binder of v_n does not contain the pronoun itself, and v_n c-commands the pronoun.

This condition accounts for a range of cases where bound variable pronouns are allowed or disallowed by virtue of transitivity, including the following (many of these are not cited from Higginbotham (1980b, 1983) but included here for completeness). Below, we shall say that the well-formed examples in (20) through (23) (except (20a) and (21a)), and the ill-formed examples in (24) through (27) (except (24a) and (25a)) display the 'Transitivity Effect'.

- (20) a. ✓ every boy_i loves his_i mother
 b. ✓ every boy's_i mother loves him_i
 b'. every boy's_i [t_i mother]_j t_j loves him_i
 c. ✓ every boy's_i mother's husband loves him_i
- (21) a. ✓ which boy_i t_i loves his_i mother
 b. ✓ [which boy's_i mother]_j t_j loves him_i
 b'. ✓ which boy's_i [t_i mother]_j t_j loves him_i
 c. ✓ whose_i mother loves him_i
- (22) ✓ someone in every city_i hates it_i
- (23) a. ✓ [which picture of which man_i]_j t_j pleases him_i
 b. ✓ which man_i [which picture of t_i]_j t_j pleases him_i

In (20a), the relevant V-chain consists of the single trace left by *every boy* at LF; since it c-commands the pronoun, the structure is licit. (20b & c) are well-formed by transitivity: the relevant V-chain for (20b) is (t_i, t_j) as given in its LF (20b'); the pronoun is c-commanded, as required, by the foot of the V-chain t_j . The same reasoning accounts for the well-formedness of the Wh-examples in (21a) and (21b), respectively. Similarly, (22) and (23) are well-formed by transitivity: for example, the pronoun *him* in the LF for (23a), (23b), is c-commanded by the foot of the V-chain (t_i, t_j) .

By contrast, a bound pronoun is not licit if it is not accessible to the trace of its operator through a chain of c-command. The following cases of weak crossover are predicted.

- (24) a. * his_i mother loves every boy_i
 b. * his_i mother loves every boy's_i father
 b'. every boy's_i [t_i father]_j his_i mother loves t_j
 (25) a. * which boy_i does his_i mother love t_i
 b. * [which boy's_i father]_j does his_i mother love t_j

 (26) * its_i climate annoys someone in every city_i
 (27) * which picture of which man_i does his_i mother like t_i

In the LF for (24a), the pronoun will not be c-commanded by the trace of *every boy* in object position, hence its ill-formedness. The pronoun in (24b) is not licensed by transitivity, since in the associated LF (24b') the trace of the container of *every boy* does not c-command the pronoun. Again, similar reasoning accounts for (25) through (27).

Turning finally to strong crossover, the following cases are each excluded on the same grounds as their weak crossover counterparts in (24) through (27).

- (28) a. * he_i loves every boy_i
 b. * he_i loves every boy's_i father
 (29) a. * which boy_i does he_i love t_i
 b. * [which boy's_i father]_j does he_i love t_j
 (30) * it_i annoys someone in every city_i
 (31) * [which picture of which man_i]_j does he_i like t_j

These examples of strong crossover can also be excluded as binding condition C violations, some ((29b) and (31)) after reconstruction at LF (see e.g. Chomsky 1977b, 1981). Note, however, that Higginbotham does not rely on reconstruction to account for any of these cases. If he did assume that material pied-piped by Wh-movement is returned to its D-Structure position at LF, then the transitivity effect in e.g. (21b) could no longer be explained by means of the V-chain mechanism, as the

reconstructed material [t_i *mother*] would then cover the V-chain foot and the pronoun would not be licensed. Hence, reconstruction at LF is not an option for Higginbotham. Nevertheless, a reconstruction approach to these data may be preferable. The strong crossover examples in (28) through (31) are usually considered to be less acceptable than the weak crossover violations in (24) through (27). This distinction cannot be accounted for within Higginbotham's framework, since both types of examples are excluded as violations of the accessibility condition. The distinction is explained, on the other hand, if we assume that weak crossover violates some condition on bound variable pronouns, while strong crossover violates both this condition and binding condition C.

I believe that the examples in (20) through (31) can be used to establish two points. Firstly, the perfect parallelism that obtains between Wh-operators and Quantified NPs as pronominal binders, even in exceptional cases, is strong *prima facie* evidence that pronominal binding with both types of binders is subject to the same conditions. This point has, of course, often been stressed in the literature discussed here, and elsewhere. More importantly, the perfect generality of the Transitivity Effect, both with QNPs and Wh-operators, and with operators both in specifier position and in complement position, is evidence that transitivity must be a real and distinctive property of the grammatical mechanism responsible for these data. Below, we shall judge the empirical adequacy of some other proposals by their success in explaining these two observations.

Higginbotham's proposal is quite adequate as a description of the examples cited above. As an explanation, however, it is less than satisfactory, since the notion of V-chain is entirely *ad hoc* and has not, to my knowledge, been shown to play a role in any other grammatical phenomenon. Hence, the transitivity effect is stated, rather than explained by this mechanism. Furthermore, the accessibility condition does not suffice as a condition on variable binding, but must be supplemented with the stipulation that pronominals may be linked only to A-positions. Finally, some version of the Scope Condition is also required in this account. To see this, consider (32) and (33).

- (32) a. * [a man with every opportunity_i]_j should grab it_i
 b. * [a man [every opportunity]_i with t_i]_j t_j should grab it_i
 (33) a. * [some boy who was in love with every girl_i]_j kissed her_i
 b. * [some boy who [every girl]_i was in love with t_i]_j t_j kissed her_i

An operator contained in an operator that c-commands a pronoun can bind the pronoun by transitivity, provided, of course, that the embedded operator takes scope over the operator that contains it. As May (1977) noted, this is almost always the case, since the inversely linked reading is usually the more prominent. Nevertheless, a narrow scope reading for the embedded NP is sometimes possible in these structures, as (32) shows (it is not entirely clear where the embedded NP should go after QR in (32b), but this is not relevant to the matter at hand). When the containing NP is more

complex, as in (33), narrow scope for the embedded NP is the only available reading. In each of these cases, the pronoun is licensed by the V-chain (t_i, t_j) at LF, but the bound reading is nevertheless unavailable. Consequently, some additional condition, presumably the Scope Condition, must be invoked to rule out these cases.

4.1.3. Reinhart (1983), (1987)

In chapter 2 we started out with a discussion of the two uses of pronouns. Pronouns may be used either referentially or as bound variables. Pronouns used as bound variables (either bound by non-referential expressions such as QNPs or Wh-operators, or variable-bound by referential expressions, yielding a sloppy reading in VP-deletion contexts) are subject to a set of conditions that includes the conditions of the Theory of Binding. Pronouns that are used referentially (deictically, and perhaps 'accidentally' co-referential with other referential expressions, yielding non-sloppy readings in VP-deletion contexts) are not subject to any specific conditions, and can perhaps be argued not to be subject to any conditions of sentence grammar at all, including the Theory of Binding. In chapter 2, we argued that the existence of referential pronouns obviates the relevance of certain examples of 'anaphora' (such as cross-sentential anaphors) to questions of donkey-anaphora. We are forced, instead, to concentrate on examples where the interpretive dependence of pronouns on weak quantified expressions cannot be described in terms of a 'deictic' interpretation of the pronoun (see, e.g. the distinction between examples (18) and (19) in chapter 2, section 2.2.). We also noted that these considerations open up the possibility of a unification of the Theory of Binding with the conditions on bound variable pronouns, since other pronouns may not be relevant to the Binding Theory. This point of view is largely due to Reinhart's work on anaphora (Cf. e.g. Reinhart 1983, 1986, 1987). We will first discuss Reinhart (1983) here, and then consider the modifications in Reinhart (1987).

Reinhart (1983) assumes that any pronominal that is coindexed with a full NP is interpreted as a variable. A pronoun that is coindexed with a QNP or Wh-operator is interpreted as a variable bound by the operator. A pronoun coindexed with a definite NP is interpreted as a variable bound by the lambda operator that constructs the predicate that operates on the NP (giving the sloppy reading in VP-deletion contexts, see chapter 2, section 2.1.). Pronouns that are not coindexed with any full NP may still be co-referential with an NP (which is possible only if the NP happens to be referential), subject only to pragmatic restrictions. Thus, the Theory of Binding deals only with bound variable interpretations.

The Binding Conditions are stated as conditions on the coindexing procedure (Reinhart also considers some alternative formulations, but the distinctions are not relevant here). Pronominals may only be coindexed under c-command, with positions not in COMP; a [+p,-a] pronominal may not be coindexed with a position within its Minimal Governing Category; a [-p,+a] pronominal must be coindexed with a position

within its MGC.¹ These conditions cover the basic restrictions on bound variable pronouns in the following way.

- (34) a. every boy_i loves his_i mother
 b. * his_i mother loves every boy_i
 c. who_i t_i loves his_i mother
 d. * who_i does his_i mother love t_i

His in (34a) may be coindexed with *every boy* under c-command, and is interpreted as a bound variable as a consequence. Since Reinhart does not assume a rule of QR, *his* in (34b) is not c-commanded by the object at any level, hence the coindexation is ruled out. *His* in (34c) is coindexed with the trace of *who*; the pronoun in (34d) may not be coindexed with the trace, due to lack of c-command, nor with the Wh-operator, since the operator is in COMP.

Reinhart's is probably the most elegant statement of the anaphora question to have appeared within the GB framework. However, it suffers from a number of empirical defects which will lead me to conclude that incorporating the conditions on bound variable pronouns into the Theory of Binding may not be feasible or desirable. Firstly, in previous chapters we have argued in favor of a rule of QR, which is incompatible with Reinhart's (1983) account of (34b); we shall return to this below. A second, minor point is that one set of restrictions accounts for the impossibility of both weak and strong crossover, which does not explain that the latter effect is stronger than the former. More importantly, however, Reinhart's account fails to predict the Transitivity Effect observed in the previous subsection, and can even be said to predict that such an effect will not obtain. Consider (35) and (36).

- (35) a. whose_i mother loves him_i
 b. every boy's_i mother loves him_i
 c. * whose_i mother loves himself_i
 d. * every boy's_i mother loves himself_i

¹ These conditions are not entirely correct as stated. They predict that a bound reading for the pronouns should be possible in (i),

(i) * who_i t_i believes that he_i improves him_i

where both pronouns have been coindexed with the matrix subject. An example like this seems to indicate that the binding conditions should be stated as output conditions, along the lines discussed by Reinhart; (1983) at a later point. The restriction that the antecedent may not be in COMP, however, can be stated more easily as a condition on the coindexing procedure; but see footnote 2.

- (36) a. someone in every city_i hates it_i
 b. which picture of which man_i pleases him_i
 c. * someone in every city_i hates itself_i
 b. * which picture of which man_i pleases himself_i

The ill-formedness of (35c & d) and (36c & d) illustrates the fact that the Binding Conditions do not exhibit a transitivity effect. Anaphors must be coindexed with a c-commanding NP, not with some NP contained in a c-commanding NP. Pronouns may not be coindexed with a local c-commanding NP, but may be coindexed with a local NP contained in a c-commanding NP. If the Transitivity Effect is a distinctive property of the conditions on variable binding, as we have argued, then an attempt to reduce these conditions to the Binding Theory, which distinctly lacks such an effect, is unlikely to be entirely satisfactory.

The well-formedness of (35a & b) and (36a & b) is unexpected under Reinhart's (1983) account, as the pronouns are not c-commanded by their antecedents. With reference to (35a & b), Reinhart considers the possibility of extending the definition of c-command in such a way that the specifier of an NP c-commands anything the NP c-commands. This implies that the required transitivity effect is built into the definition of c-command. Of course, this move only shifts the problem around, since now the ill-formedness of (35c & d) is unexpected. Reinhart suggests that the binding conditions can be adjusted to state that an anaphor and its antecedent must be contained in the same MGC. If we interpret this as implying that the anaphor's MGC must be the minimal NP or S that dominates the antecedent, it effectively reintroduces the strict c-command requirement into the binding conditions. Thus it accounts for the ill-formedness of (35c & d) since in each case the antecedent, although c-commanding the anaphor under the new definition, is contained in an NP that does not contain the anaphor.

Reinhart does not propose a similar solution for the examples in (36), as she does not consider (36a & b) to be representative data. But, obviously, we can easily adjust the definition of c-command again, to state that anything c-commanded by an NP is c-commanded by its specifier or complement. It is hard to find any verifiable consequences of either of these adjustments outside the theory of binding. Movement to a position inside an NP, for example, is generally excluded on independent grounds. There is independent evidence that [Spec,DP] is not a proper landing site for NP-raising, since no structural case is assigned to this position; similarly, Wh-movement into DP is out because [Spec,DP] is not a Wh-position. Consider, however, (37).

- (37) someone in New York_i hates it_i, but someone in Los Angeles does not

Even those speakers that find (36a) perfectly acceptable will not accept a sloppy reading for (37), indicating that *New York* in (37) does not bind the pronoun from its S-Structure position.

Descriptive difficulties of this kind will not, of course, decide the question whether the conditions on bound variable pronouns can be derived from the Binding Theory. Nevertheless, we suggest that Reinhart's approach is undesirable, since reducing bound anaphora to the binding conditions, rather than explaining the transitivity effect, requires elaborate adjustments to circumvent the prediction that there will be no transitivity effect.

Reinhart (1987) adopts a QR perspective of LF derivation. This renders her proposal more compatible with the general framework we have adopted here, but also necessitates some adjustments to her analysis of anaphoric binding which make it less straightforward. If quantified NPs are moved by QR, then it will be possible to co-index *his* in (34b) (repeated here) with *every boy* under c-command at LF.

(34) b. * his_i mother loves every boy_i

Reinhart (1987) rules out (34b) by assuming that pronouns may only be interpreted as variables bound by operators that they are bound by at S-Structure, prior to the operation of QR. This means that the interpretation of pronouns, which is an LF-operation, is made to depend on structural relations obtaining at a previous level of representation. This is implemented through an explicit ordering of rules, which requires that pronominal interpretation takes place prior to Quantifier Raising.

Reinhart (1987) also adopts Chomsky's (1981) position that coindexing obtains freely between NP positions. Consequently, the conditions on pronominal binding can no longer be stated as conditions on coindexing. Instead, Reinhart postulates that any pronoun bound at S-Structure by a constituent α may be interpreted as a variable bound by the interpretation of α (where, again, any pronoun c-commanded by X may be bound by the specifier of X). This has the effect of allowing (weak) crossover with Wh-operators, as in (34d) (repeated).

(34) d. * who_i does his_i mother love t_i

Since the pronoun is freely coindexed with and bound by *who* at S-Structure, nothing prevents a bound interpretation in this example. Consequently, Reinhart's analysis now explains neither the Transitivity Effect nor the parallelism between Wh-operators and Quantified NPs described in our section on Higginbotham (4.1.2.).²

One final point remains to be made about Reinhart's work discussed here. Like the proposals by Chomsky and Higginbotham reviewed earlier, Reinhart's proposals

² Reinhart; (p.c.) has suggested that perhaps pronouns may not be bound from a position in COMP in English. This suggestion opens up the possibility of unifying the conditions on binding by Wh-operators and binding by Quantified NPs as follows. Parallel to the Binding Theory, which, by Chomsky; (1981), is a theory of A-binding, a theory of A-bar binding can perhaps be developed, which states that pronominals must be locally A-bar free at LF. This would still leave the Transitivity cases unaccounted for, however.

require the operation of a Scope Condition to rule out certain inadmissible cases of bound anaphora. Consider (38) and (10a) (repeated).

- (38) * Every boy's_i best friend, Baden Powell, loves him_i
 (10) a. some musician_i will play [every piece you want him_i to]_j

Although the pronoun in (38) can be variable-bound from the position occupied by *every boy*, the example is ill-formed in the intended reading. The appositive NP forces the specifier to take narrow scope relative to the subject it is contained in. Consequently, the pronoun will not be in the scope of its operator³. Similarly, (10a) allows the pronoun to be bound by the subject, but only if the object takes narrow scope.

4.1.4. Haïk (1984)

Haïk (1984) develops a system of pronominal licensing which governs not only bound variable interpretations, but coreference as well. One version of her Condition on Variables is given in (39) (= Haïk 1984:(61)).

- (39) a. Pro_i must be c-commanded by NP_i, if NP_i is an inherent quantifier.
 b. Pro_{i/j} must be c-commanded either by NP_{i/j} or by NP_{j(i)} (Indirect Binding).

Here, inherent quantifiers are strongly quantified NPs and Wh-phrases. NP_{i/j} is any NP_i which has been written in the scope of NP_j through Haïk's Scope Indexing mechanism. We will discuss the Indirect Binding case in section 4.2.3..

Haïk's assumption appears to be that a pronoun must be coindexed with a full NP for it to be interpreted as coreferential with that NP, or variable-bound by it (depending on the interpretation of the NP itself). By (39), coindexing without c-command is possible only with NPs which are neither strongly quantified nor in the scope of any quantifier. This would appear to explain the interpretation of the discourses in (40a) and (40b) (= Haïk 1984:(15)).

- (40) a. * *Every boy* came in. *He* looked happy.
 b. Two men love *a woman*. *She* looks nice.

The pronoun in (40a) cannot be coindexed with *every boy* by (39a), since the antecedent is an inherent quantifier that does not c-command it. The pronoun in the second clause of (40b) can be coreferential with *a woman*, but only if *a woman* takes wide scope (i.e. is not written in the scope of *two men*), since in that case neither clause of (39) applies. This correctly describes the possible interpretations of (40a &

³ Similar examples can be found e.g. in Koster; (1992).

b). Thus, the scope indexing mechanism, together with the syntactic notion of inherent quantifier, make it possible to give a definition of the class of NPs that allow free coreference, in purely syntactic terms.

We have argued earlier (in chapter 2, sections 2.1. through 2.3.) that 'deictic' pronouns always have the option of 'accidentally' referring to individuals made salient elsewhere in the discourse. As a consequence, there can be little point in formulating principles of sentence grammar that restrict coreference in configurations in which 'accidental' co-referentiality is pragmatically allowed, since any interpretations that cannot arise through grammatical coreference may then nevertheless arise accidentally. This may essentially counteract any prohibitive predictions that follow from the grammatical conditions on coreference. Thus, consider (41).

- (41) a. *Every boy* came in. *They* looked happy.
 b. Two men love *a woman*. *They* look nice.

In (41a), *they* may happen to refer to the set of boys that came in. In (41b), *a woman* can take narrow scope, and the pronoun in the second clause can then refer to the set of women involved in verifying the antecedent clause. With reference to examples like (41), Haïk states that (in accordance with her conditions on coindexing), the pronouns in such examples are not coreferential with the full NPs. But obviously, if coreference does not obtain in (41), then some other account must be given of the pronouns in these examples. And any account for the interpretation of the pronouns in (41) may equally well apply to pronouns that Haïk does consider to be coreferential with full NPs, thereby obviating the need for any grammatical notion of coreference.⁴

Turning now to bound variable pronouns, Haïk's treatment of these is quite similar to the proposal in Reinhart (1983). Since there is no QR in Haïk's theory, it follows from (39a) that there can be no coindexing (hence no bound reading) in (42).

- (42) a. * he_i loves every boy_i
 b. * his_i mother loves every boy_i

With reference to (43), Haïk writes that "...the pronoun is not c-commanded by its antecedent" (1984:200).

- (43) * who_i did his_i wife love t_i

Apparently, either we should understand (39) to refer only to NPs in A-position, or Haïk assumes that the Wh-phrase in (43) is embedded in a coindexed Comp-node, so that the pronoun and the object trace are not c-commanded by the NP (the latter option is not available in the general framework adopted here).

Obviously, Haïk's analysis excludes variable binding by transitivity. She cites

⁴ These remarks are largely based on the view defended by Reinhart; (1983).

some data from French to support this position, leaving the relevant English examples as problematic. Consider (44) (= Haïk 1984:(8)).

- (44) * [La femme près de [chaque homme]_j]_i ressemble à sa_j mère
'The woman next to each man looks like his mother'

According to Haïk, wide scope for *chaque homme* is possible in (44), but the bound reading is nevertheless unavailable. However, the French data may not be quite as clear as Haïk suggests. I am informed that inversely linked readings are usually unavailable in French.

- (45) [quelques gens de chaque catégorie sociale] aiment le jazz
'some people from every social stratum like jazz'

According to my informant, *chaque catégorie sociale* cannot take wide scope in (45), despite the fact that the narrow scope reading is quite odd pragmatically. Nevertheless, in some cases (the distinction perhaps having to do with the definiteness of the containing NP), inverse linking is possible. Compare (44) with (46).

- (46) [le chien près de chaque homme_i] lui_i a rapporté le chapeau
'the dog close to each man returned him his hat'

The same informant that ruled out inverse linking in (45) considered the bound reading in (46) acceptable if *chaque homme* was given wide scope. The contrast between (44) and (46) can perhaps be explained by the following, speculative considerations. In (44), the pronoun can be interpreted as bound by the subject *la femme près de chaque homme*. Since this reading does not require inverse linking, we may perhaps expect it to be more prominent than the intended reading. In (46), on the other hand, Binding Condition B and pragmatic factors conspire to rule out the subject-bound reading, thus making available the less natural reading with inverse linking and binding by transitivity.

Finally, the following example shows that Haïk cannot do without some version of the Scope Condition.

- (47) every musician_{i/j} will play [some piece you want him_{i/j} to]_j

The indexing in (47) is allowed under Haïk's assumptions: *every musician* has been scope indexed by the object under S-command; the pronoun is coindexed with a c-commanding NP. Nevertheless, *him* cannot be interpreted as a variable bound by *every musician*, since it is contained in a constituent that is outside the scope of the

operator. Therefore some additional principle must rule out the bound variable interpretation of the pronoun in this structure.

4.1.5. Koopman & Sportiche (1982)

Koopman & Sportiche (1982) propose the following principle:

- (48) *The Bijection Principle* (= K&S 1982:(20))
 There is a bijective correspondence between variables and A-bar positions.

A variable is here defined as any locally A-bar bound NP (trace or pronoun) in an A-position; thus, the BP refers to a purely syntactic notion of 'variable', whose extension does not coincide with the class of NPs that are semantically interpreted as bound variables. The Bijection Principle (BP) covers the basic restrictions on bound variable pronouns in the following way.

- (49) a. $\text{who}_i \text{ } t_i \text{ loves his}_i \text{ mother}$
 b. * $\text{who}_i \text{ does his}_i \text{ mother love } t_i$

The pronoun in (49a) is not a variable in the sense of the BP, as it is locally A-bound by the trace in subject position. Therefore, the operator *who* binds only one syntactic variable, the BP is satisfied, and the pronoun can be semantically interpreted as a variable. In (49b), the pronoun is a variable in the syntactic sense. Therefore, the single operator *who* binds two variables, and this structure violates the BP. Similar considerations exclude weak crossover with Quantified NPs; strong crossover violations are attributed to the improper A-binding of the trace, as in Chomsky (1981).

Empirically, the BP is quite similar to Reinhart's S-Structure c-command condition. A pronoun that is bound by an NP in A-position at S-Structure will generally be locally A-bound by (the trace of) that NP at LF, hence be irrelevant to the BP. Conversely, a pronoun that is not A-bound at S-Structure, will be locally A-bar bound by any coindexed operator that c-commands it at LF, hence will violate the BP. One exception to the former implication occurs in case the pronoun itself is moved at LF, out of the c-command domain of the NP that A-binds it at S-Structure. (10a) (repeated again as (50a)) is an example.

- (50) a. some musician_i will play every piece you want him_i to
 b. [_S some musician_i [_S [every piece you want him_i to]_j [_S t_i will play t_j]]]
 c. [_S some musician_i [_S t_i will [_{VP} [every piece you want him_i to]_j [_{VP} play t_j]]]]

The pronoun *him*, licensed at S-Structure in (50a) under Reinhart's c-command condition, and licensed in an intermediate representation by Higginbotham (1980a),

will violate the BP (and Higginbotham's (1980b,1983) accessibility condition) if the object is adjoined to S at LF (as in (50b)). Since Koopman & Sportiche assume instead that the quantified object can adjoin to VP (as in (50c)), the BP (or the accessibility condition) is satisfied.

The similarity between the Bijection Principle and the S-Structure c-command condition also leads to similar problems. The BP rules out all examples that are well-formed by virtue of the Transitivity Effect. Consider (51).

- (51) √ every city_i [someone in t_i]_j t_j hates it_i

Every city in the LF (51) locally A-bar binds both its trace and the pronoun in object position, thereby violating the BP.

Some further problems for the BP were noted by Safir (1984). Firstly, the BP rules out well-formed examples of Across-the-Board extraction, as in (52).

- (52) √ which book_i did you [take t_i from Bill] and [give t_i to Peter]

The Wh-operator binds two variables in this structure; the same is true in (53).

- (53) a. * who_i did you give a picture of t_i to him_i
 b. * who_i did you give a picture of him_i to t_i
 c. ? who_i did you give a picture of t_i to t_i

The BP correctly rules out (53a & b). It also rules out (53c), however, which Safir considers to be not quite as bad as (53a & b). The examples in (52) and (53) suggest that the principle responsible for weak crossover should perhaps be formulated as a condition on pronominal variable binding, not as a condition on variable binding in general.

Finally, the Bijection Principle (BP) is supplemented by the following condition.

- (54) *The Scope Condition* (= K&S 1982:(27))
 A pronoun may be coindexed with a variable bound by a (quasi-) quantifier (i.e. *wh*-phrases, quantifiers subject to QR), only if it is in the scope of the (quasi-)quantifier at LF.

This condition is required to rule out such examples as (8) (repeated here).

- (8) a. * [every soldier_i is armed], but will he_i shoot
 b. * [every soldier_i t_i is armed], but will he_i shoot

In the LF (8b), the pronoun is not bound by the quantifier at all, so that the BP is not violated here, but the Scope Condition is.

4.1.6. Safir (1984)

Safir (1984) improves upon Koopman & Sportiche's Bijection Principle on two points. Firstly, his PCOB allows for well-formed non-bijective A-bar binding configurations if none of the variables are pronouns, as in (52) and (53c) cited above. The PCOB is given in (55).

- (55) *The Parallelism Constraint on Operator Binding (PCOB)*
 (= Safir 1984:(28a))
 If O is an operator and x is a variable bound by O, then for any y , y a variable bound by O, x and y are [α lexical].

This constraint forbids the usual cases of weak crossover, where a pronoun ([+lexical]) and a trace ([-lexical]) are both A-bar bound by an operator, but does not rule out (52) and (53c), since they both contain only non-lexical variables.

Secondly, Safir strengthens the descriptive adequacy of the PCOB by postulating a mechanism which accounts for the Transitivity Effect. Like Reinhart's c-command condition, the BP and the PCOB fail to derive this effect directly because they refer to the status of bound variable pronouns with respect to the Binding Theory. All three analyses require pronouns that are to be interpreted as bound variables to be A-bound; bound pronouns that are not A-bound will count as syntactic variables and cause a violation of the BP or PCOB. Since the Binding Theory does not display a transitivity effect, the BP and the PCOB also do not predict such an effect. Safir's solution is rather similar to the V-chain mechanism described by Higginbotham (1983). Safir gives the following definition.

- (56) *Q-Chain* (= Safir 1984:(44))
 A Q-chain is a sequence of adjacent A-bar binding constituents [$O_1, O_2, \dots O_n$] such that O_{m-1} binds a variable in O_m for any value of m [except 1, presumably *ÆEGR*]. The initial O_1 of the Q-chain is the "Q-chain head". The variable bound by O_n is the "Q-chain variable."

(56) defines the appropriate transitivity relation; Safir considers two ways of employing it so as to exempt transitivity cases from the PCOB. One possibility is simply to state that a pronoun that is c-commanded by the Q-chain variable of the Q-chain headed by its binder is not 'analyzable' for the PCOB. The second, more interesting possibility is to say that the referential index of the Q-chain head is attached (under a slash) to the index of the Q-chain variable. Safir cites Haïk (1984)

for this mechanism⁵. The relevant examples would now appear to be accounted for as follows.

- (57) a. [someone in every city_i]_j hates it_i
 b. [_S every city_i [_S [someone in t_i]_j [_S t_{j/i} hates it_i]]]

In the LF (57b), the Q-chain variable in subject position counts as an A-binder of the pronoun in object position, as the index of the pronoun has been attached to the index of the variable. Consequently, the pronoun does not count as a variable for the PCOB. Through these assumptions, the Transitivity Effect appears to have been incorporated into the Binding Theory. However, as in the case of Reinhart's extension of c-command (see subsection 4.1.3. above), problems now arise for standard cases of A-binding. Consider also (58).

- (58) a. * every boy's mother loves himself_i
 b. * every boy's_i [t_i mother]_j t_{j/i} loves himself_i

In (57b) the pronoun *it* is locally A-bound by the subject, and so is the anaphor *himself* in (58b). We should therefore expect (57) to be in violation of Binding Condition B, and (58) to satisfy Condition A, yielding the opposite grammaticality judgments. Safir's solution to (57) is to reformulate Binding Condition B as stating that a pronoun may not have an antecedent within its MGC. Presumably, he also intends to reformulate Condition A, to state that an anaphor must have an antecedent within its MGC, so as to rule out (58). But these reformulations effectively divorce the way in which the Binding Conditions contextually determine the binding properties of NPs (by marking A-bar bound pronouns as "variables") from the way they govern the distribution of anaphoric and pronominal NPs, by introducing a notion of 'antecedent' which is relevant in the latter case but not in the former⁶.

Furthermore, Condition C should also be reformulated, so as to preempt any Binding Theory effects that might be expected from the slash indexing mechanism. Otherwise, we would expect the epithet *the bastard* in (59a) to violate condition C at LF (59b) (Cf. the ill-formedness of (60)).

- (59) a. ✓ every boy's mother loves the bastard_i
 b. ✓ every boy's_i [t_i mother]_j t_{j/i} loves the bastard_i

⁵ But unlike Haik, Safir, apparently does not intend to interpret these slash indices as Scope Markings (if at all). If scope were marked through slash indices, then in a Q-chain [O₁, ... O_n] each operator O_i, 1 ≤ i < n, should assign its slash index to O_{i+1}.

⁶ An alternative would have been for Safir, to stipulate that the Binding Conditions apply at S-Structure, prior to the construction of Q-chains. However, this would have left him without an account of the strong ungrammaticality of strong crossover cases like *whose_i mother does he_i love*, which violate condition C only at LF.

- (60) * every boy_i loves the bastard_i

However, such a reformulation of Condition C would counteract Safir's intended explanation of the ill-formedness of (61):

- (61) a. whose mother does he love
 b. whose_i [t_i mother]_j does he_i love t_{j/i}

Instead of assuming a rule of reconstruction to lower the trace of *whose* into the c-command domain of the pronoun at LF, Safir attributes the increased ill-formedness of (61) to the slash-index on the object trace being bound by the subject, in violation of Binding Condition C. But this explanation is incompatible with the well-formedness of (59), and also necessitates an asymmetry among the Binding Conditions, in that slash indices are irrelevant to Conditions A and B, but not to Condition C.

In sum, although Safir's proposal covers an impressive range of facts, it also combines the drawbacks of both Reinhart's and Higginbotham's proposals. With Higginbotham's analysis it has in common an entirely ad hoc 'transitivity' device (the notion of Q-chain); and Safir's reliance on Binding Theoretical notions for a description of the conditions on bound variable pronouns again appears to stand in the way of explanatory adequacy.

4.1.7. May (1985)

In the final chapter of May (1985), the author turns to Pesetsky's (1982) Path Containment Condition (PCC) as a condition on (LF-)movement. May gives the following statement of the PCC.

- (62) Path Containment Condition (= May 1985:Ch.5:(6))
 Intersecting A-bar-categorical paths must embed, not overlap.

A path is defined as the set of nodes connecting a binder to its bindee. Two paths are said to intersect iff they share a path-segment, i.e. a pair of contiguous elements. Consider (63) as an example.

- (63) a. who_i admires what_j
 b. [_{S'} [_{NP2} what_j [_{NP1} who]]_i [_S t_i [_{VP} admires t_j]]]
 path(t_i) = { S, S' }
 path(t_j) = { VP, S, S', NP2 }

By May's assumptions, the Wh-in-situ in (63a) is adjoined to the Wh-phrase in COMP at LF (63b), creating the node labelled NP2. The resulting paths overlap (they have the segment {S, S'} in common), but since the path generated by the subject is embedded

in the path of the object, the PCC is not violated. Compare (63) with the superiority violation (64).

- (64) a. * what_i does who_i admire t_j
 b. [_{S'} [_{NP2} who_i [_{NP1} what]]_j [_S t_i [_{VP} admire t_j]]]
 path(t_i) = { S, S', NP2 }
 path(t_j) = { VP, S, S' }

In (64b), the paths again overlap, and since neither path is contained in the other, the PCC is violated.

May proposes to extend Pesetsky's theory by assuming that paths are projected not only from A-bar bound traces, but from A-bar bound pronouns as well. This assumption will exclude typical examples of crossover, while permitting all bound variable pronouns which are locally A-bound⁷. More importantly, a path containment account of bound variable pronouns seems quite naturally to incorporate the Transitivity Effect. Consider first (65).

- (65) a. * [_{S'} who_i [_S does [_{NP} his_i mother] [_{VP} like t_i]]]
 path(t_i) = { VP, S, S' }
 path(his_i) = { NP, S, S' }
 b. * [_{S2} everyone_i [_{S1} [_{NP} his_i mother] [_{VP} likes t_i]]]
 path(t_i) = { VP, S1, S2 }
 path(his_i) = { NP, S1, S2 }

The S-Structure (65a) and the LF (65b) both violate the PCC, as the paths projected from the pronouns and the paths projected from the traces overlap without embedding. (66) is excluded as well (irrelevant path-members omitted).

- (66) a. * its_i climate annoys [someone in every city_i]
 b. * [_{S2} [_{NP2} every city_i [_{NP1} someone in t_i]]_j [_{S1} [_{NP3} its_i climate] [_{VP} annoys t_j]]]
 path(t_i) = { ... , NP1, NP2 }
 path(t_j) = { VP, S1, S2 }
 path(its_i) = { NP3, S1, S2, NP2 }

By May's assumptions, an inversely linked QNP is adjoined at LF to the NP it is contained in at S-Structure, creating the node NP2 in (66b). In this example, the path projected from the pronoun, and the path projected from the trace in object position violate the PCC, making this a weak crossover violation by transitivity. Now compare (66) with (67).

⁷ A Scope Condition is also required under this analysis, to bar such examples as * *every soldier_i is armed, but will he_i shoot.*

- (67) a. [someone in every city_i]_j hates it_i
 b. [_{S2} [_{NP2} every city_i [_{NP1} someone in t_i]]_j [_{S1} t_j [_{VP} hates it_i]]]
 $\text{path}(t_i) = \{ \dots, \text{NP1}, \text{NP2} \}$
 $\text{path}(t_j) = \{ \mathbf{S1}, \mathbf{S2} \}$
 $\text{path}(it_i) = \{ \text{VP}, \mathbf{S1}, \mathbf{S2}, \text{NP2} \}$

Since the path of the pronoun properly embeds the path of the trace of the lower operator, there is no PCC violation in this 'transitivity' case.

Nevertheless, in spite of its obvious advantages, I do not believe that May's analysis is on the right track. Apart from weak crossover, all available evidence indicates that A-bar bound pronouns do not project paths⁸. Putative paths projecting from A-bar bound pronouns may intersect with paths rooted in Wh-traces, in QNP-traces, or in other A-bar bound pronouns without violating the PCC. Consider first example (68), where $\text{path}(\text{he})$ and $\text{path}(\text{it})$ improperly intersect (irrelevant paths omitted).

- (68) a. √ someone in every city_i told every boy's_j mother that he_j would love it_i
 b. [_{S2} [_{NP2} every city_i [_{NP1} someone in t_i]]_k [_{S1} t_k [_{VP2} [_{NP4} every boy's_j [_{NP3} t_j mother]]_m [_{VP1} told t_m [_{S3} he_j would [_{VP3} love it_i]]]]]]
 $\text{path}(\text{he}_j) = \{ \mathbf{S3}, \mathbf{VP1}, \mathbf{VP2}, \text{NP4} \}$
 $\text{path}(\text{it}_i) = \{ \text{VP3}, \mathbf{S3}, \mathbf{VP1}, \mathbf{VP2}, \text{S1}, \text{S2}, \text{NP2} \}$

Obviously, any sentence containing two inversely linked quantifiers A-bar binding two pronouns will be less than natural. Nevertheless, I believe that (68) is not a PCC violation, despite the fact that the paths projected from the two pronouns have an improper intersection (whether the object NP is adjoined to VP or to S is irrelevant here). The same is true in (69).

- (69) √ every girl's_i mother believed that every boy's_j father would let him_j kiss her_i

Consider next (70).

- (70) a. √ someone in every president's_i home town_j introduced him_i to its_j mayor
 b. [_{S2} [_{NP2} [_{NP4} every president's_i [_{NP3} t_i home town]]_j [_{NP1} someone in t_j]]_k [_{S1} t_k [_{VP} introduced him_i [_{PP} to [_{NP5} its_j mayor]]]]]]
 $\text{path}(\text{him}_i) = \{ \mathbf{VP}, \mathbf{S1}, \mathbf{S2}, \mathbf{NP2}, \text{NP4} \}$
 $\text{path}(\text{its}_j) = \{ \text{NP5}, \text{PP}, \mathbf{VP}, \mathbf{S1}, \mathbf{S2}, \mathbf{NP2} \}$

Again, although the pronouns' paths intersect improperly, there is no weak crossover effect here with the double inversely linked reading. More significantly, however, by

⁸ For other problems attending May's analysis, see Epstein; (1989).

May's account (70) ought to be distinctly worse than (71), which does not violate the PCC.

- (71) a. \checkmark someone in every president's_i home town_j described it_j to his_i wife
 b. $[_{S2} [_{NP2} [_{NP4}$ every president's_i $[_{NP3}$ t_i home town $]]_j [_{NP1}$ someone in t_j $]]_k$
 $[_{S1}$ t_k $[_{VP}$ described it_j $[_{PP}$ to $[_{NP5}$ his_i wife $]]]]]$
 $path(it_j) = \{ \mathbf{VP}, \mathbf{S1}, \mathbf{S2}, \mathbf{NP2} \}$
 $path(his_i) = \{ \mathbf{NP5}, \mathbf{PP}, \mathbf{VP}, \mathbf{S1}, \mathbf{S2}, \mathbf{NP2}, \mathbf{NP4} \}$

There is no such contrast, however.

We turn now to some less complicated examples, where a path rooted in a pronoun would interfere with a Wh-headed path.

- (72) a. \checkmark every boy's_i mother knows what_j he_i likes t_j best
 b. $[_{S2} [_{NP2}$ every boy's_i $[_{NP1}$ t_i mother $]]_k [_{S1}$ t_k $[_{VP1}$ knows $[_{S'}$ what_j $[_{S3}$ he_i
 $[_{VP2}$ likes t_j best $]]]]]$
 $path(t_j) = \{ \mathbf{VP2}, \mathbf{S3}, \mathbf{S'} \}$
 $path(he_i) = \{ \mathbf{S3}, \mathbf{S'}, \mathbf{VP1}, \dots \}$

The path headed by *what* does not appear to conflict with a path projecting from the pronoun. The same point can be made about (73).

- (73) \checkmark what_j does every boy's_i mother like t_j best about him_i

Similar examples can be constructed with pronouns that are A-bar bound by Wh-operators:

- (74) \checkmark which book about which man_i makes you wonder what_j he_i really wanted t_j

Examples that can be used to establish whether paths rooted in A-bar bound pronouns conflict with paths headed by Quantified NPs again tend to be rather complicated. Nevertheless, although intuitions are very insecure, I believe that (75) shows that no conflict arises:

- (75) \checkmark someone in every city_i told some story about its_i mayor to every reporter

In (75), if *every reporter* is given scope over the direct object by adjoining it to a

higher VP-node, then its path and the path of the pronoun should overlap, thus ruling out this reading⁹.

One especially attractive property of Pesetsky's path theory is that it can explain the CSC and its ATB exceptions, on the basis of the assumption that the conjoined nodes in a coordinated structure are joined by a path. This path will be improperly intersected by any path leading out of one conjunct, without also leading out of the other conjunct. May's proposal would therefore lead us to expect that (76a) and (76b) should be equally unacceptable CSC-violations.

- (76) a. * what_i did John [_{VP} [_{VP} take a book from Bill] and [_{VP} give t_i to Peter]]
 b. √ every soldier's_i mother [_{VP} [_{VP} said a few prayers] and [sent him_i to the front]]

The examples in (68) through (76) make it quite clear that A-bar bound pronouns do not generate paths to their binders in general, and therefore argue strongly against the validity of May's approach to crossover.

4.1.8. A Scope Marking Analysis

In the foregoing sections we have reviewed a range of analyses of the weak crossover phenomenon. One class of analyses (Chomsky 1977a, Higginbotham 1980a) have been based on a directionality constraint; besides facing a number of minor empirical problems (and being theoretically somewhat outmoded), this approach cannot account for examples which are ruled out by the Transitivity Effect (see (24) through (27)). Another class of analyses (Reinhart 1983, 1987, Haïk 1984, Higginbotham 1980b, 1983, Koopman & Sportiche 1982, Safir 1984) have been based on a requirement of S-Structure Binding or A-Binding. Such a requirement, besides facing various types of minor problems as a matter of implementation, cannot account for examples which are ruled in by the Transitivity Effect (see (20) through (23)). Separate 'transitivity devices' have been stipulated as addenda to these analyses (Higginbotham, Safir), but we have found these to be less than satisfactory. Only May's (1985) Path Containment account captures the Transitivity Effect in an interesting way, but not without engendering seemingly insurmountable empirical problems in other areas.

As an alternative, we want to propose that the licensing of bound variable pronouns depends not on the Theory of Binding or on some isolated special mechanism, but on what we might want to call the Theory of Scope, as it was outlined in the previous chapter. One important reason to believe this to be a more promising approach lies in the fact that relations of scope display the property of transitivity in general. This leads us to expect that the Transitivity Effect observed in the previous

⁹ If *every reporter* is given wide scope by adjoining it to a lower VP-node (which is possible by May's Sigma-sequence theory), then the paths of the two quantifiers will improperly intersect.

sections will fall out naturally from a reduction of bound variable licensing to the Theory of Scope.

There are various possible ways of making this idea precise. Given the Scope Marking mechanism (69) proposed in chapter 3, the following condition is an obvious candidate.

- (77) Pronouns may be scope-marked only by XP in A-position.

At this point, we have no rationale to offer for the existence of condition (77); it is a stipulation completely on a par with, say, the Bijection Principle, or various other accounts that require c-command from an A-position.

The effects of the syntactic condition (77) can be tested only in combination with some statement on the semantic interpretation of pronouns. For our present purposes, the following will almost do.

- (78) **Scope Condition** (provisional)
A pronoun pro_i is interpreted as a variable bound by NP_i iff pro_i is in the scope of NP_i .

Recall that each of the proposals discussed above either contained or presupposed a similar condition. We have given it here in the form of a condition on the interpretation of LF (possibly a condition on the mapping from LF onto LF'). However, as noted earlier, we may alternatively interpret the Scope Condition as a well-formedness condition on semantic representations, or as a property of semantic clauses operating on logical formulae of some kind. Again, we do not know what empirical arguments might be brought to bear on this matter. In any event, the Scope Condition appears to me to be natural to the point of inevitability.

The statement of the Scope Condition given in (78) is slightly inaccurate, however. Obviously, a pronoun pro_i cannot be interpreted as a variable bound by XP_i , since at the level of representation where pro is mapped onto a variable (say, LF'), there is no XP_i . At best, the variable that interprets the pronoun can be said to be bound by the operator that binds the variable that results from mapping the XP in question onto that level, not by the XP itself. Therefore, we will replace (78) with the more precise (and slightly more cumbersome) statement in (79).

- (79) **Scope Condition**
 pro_i is interpreted as x_n iff NP_i is associated with x_n and the operator that binds x_n may take scope over the interpretation of pro_i

We will say that NP_i is associated with x iff the interpretation of NP_i results in the variable x being introduced into the interpretation of the LF that contains NP_i . For instance, when an LF contains an NP *every boy*, which is interpreted at LF' as a

(restricted) quantifier binding a variable x , then *every boy* is said to be associated with x through this mapping operation.

Condition (77) accounts for the licensing of bound variable pronouns in the following way. Consider first some well-formed examples.

- (80) a. every boy_i loves himself_i
 b. who_i loves himself_i

The reflexive pronoun in (80a) may be interpreted as a variable bound by the quantifier that interprets *every boy*, since it is in the scope of the quantifier. The pronoun can be scope-marked at S-Structure by *every boy*, which is then in an A-position (recall from chapter 3, that scope-marking may take place at any level of representation). The Wh-operator in (80b) may scope-mark the pronoun prior to being moved to Spec of COMP, therefore the structure is licit. Now consider some examples of weak crossover.

- (81) a. * his_i mother loves every boy_i
 b. * every boy_i his_i mother loves t_i

The pronoun cannot be scope-marked by *every boy* in the S-Structure (81a), since the QNP does not c-command the pronoun (note, that we do not need to stipulate the c-command requirement in condition (77), since c-command is a requirement for scope-marking in general). In the LF (81b), the QNP does not occupy an A-position. Consequently, the pronoun cannot be interpreted as a bound variable. Similar considerations apply to the D-Structure in (82a) and its associated S-Structure in (82b), respectively.

- (82) a. * does his_i mother love who_i
 b. * who_i does his_i mother love

Binding configurations which are licensed by the Transitivity Effect are accounted for as follows.

- (83) a. [someone in every city_i]_j hates it_i
 b. every city_i [someone in t_i]_j hates it_i

In the S-Structure (83a), the pronoun may be superscripted by the NP in subject position. At LF *every city* is extracted from the subject to take scope over it. Since the subject is not itself a pronoun, it may be superscripted from an A-bar-position. The resulting structure is interpreted as a case of inverse linking, as described in May (1977). Now observe that, by our Scope Principle, since the pronoun is written in the scope of the subject, and the subject is in the scope of *every city*, the pronoun is in the

scope of *every city* by transitivity. Therefore, the pronoun may be interpreted as a variable by (77). With this, we have derived the Transitivity Effect without any special stipulations. The other well-formed Transitivity cases cited in (20) through (23) are derived in the same way.

Compare (83) with (84), which is an ill-formed Transitivity case:

- (84) a. * $\text{its}_i \text{ climate annoys someone in every city}_i$
 b. * $\text{every city}_i [\text{someone in } t_i]_i \text{ its}_i \text{ climate annoys } t_j$

At S-Structure, the pronoun cannot be superscripted by either QNP due to lack of c-command. At LF, the QNPs that c-command the pronoun do not occupy A-positions¹⁰. Therefore, the pronoun cannot be licensed as a bound variable in this structure. Similar reasoning accounts for the other ill-formed transitivity cases in (24) through (27).

Consider next some examples of strong crossover.

- (85) a. * $\text{who}_i \text{ does he}_i \text{ like } t_i$
 b. * $[\text{whose}_i \text{ friend}]_j \text{ does he}_i \text{ like } t_j$

The pronouns in these examples cannot be interpreted as bound variables because they cannot be superscripted in the appropriate way. This means that, like some of the approaches discussed earlier (e.g. Higginbotham 1983, Safir 1984), our approach offers a uniform account of weak and strong crossover. Note, that (85b) cannot be ruled out as a condition C violation without a rule of reconstruction being assumed, which places a constituent containing the trace of *whose* back into the c-command domain of *his*. We can do without such a rule.

However, there is some reason to doubt whether the simplification thus made possible by our theory is desirable. Strong crossover examples are usually considered to be more strongly ungrammatical than examples of weak crossover. We can explain the difference if we assume that weak crossover violates a condition of the Theory of Scope, while strong crossover yields a violation of both the Theory of Scope and the Theory of Binding. Since our analysis (unlike e.g. Higginbotham's) is compatible with the notion of reconstruction at LF, we may tentatively assume here that reconstruction takes place in (85b), so that both examples in (85) violate both Binding Condition C and Condition (77). Whether this approach to the increased unacceptability of (85b) is correct can perhaps be ascertained only by considering its consequences in other areas, notably the theory of binding. We will not consider the matter further here; there is one related matter, however, which deserves some attention. Consider (86) (attributed to E. Engdahl, Cf. Engdahl 1980).

¹⁰ If our reasoning in chapter 3 is correct, then perhaps the containing NP in (84) does not undergo QR. This is not relevant to our present concerns.

- (86) [which of his_i paintings]_j does every artist_i like t_j best

The pronoun in (86) can be bound as a variable by *every artist*, although it is not c-commanded by that NP at S-Structure. This example presents no problems to an analysis of strong crossover that depends on LF reconstruction, since after reconstruction, the pronoun will be c-commanded by (the trace of) the subject. However, Koopman & Sportiche's BP, Safir's PCOB and Higginbotham's accessibility condition, which do not require reconstruction as an account of crossover in (85b), must nevertheless rely on an optional reconstruction rule to allow for (86). Furthermore, I see no way to account for (86) in the frameworks of Haïk (1984) or Reinhart (1983, 1987), which require c-command at S-Structure. Again, the analysis defended here is compatible with either approach, as the pronoun in (86) may be licensed by the QNP prior to wh-movement; as we saw in chapter 3, scopal reconstruction effects of this type are to be expected under a scope marking approach.

As noted earlier, Reinhart (1983) has shown quite convincingly that the conditions on pronouns that are to be bound by quantified expressions or question operators also determine the occurrence of 'sloppy' readings in VP-deletion contexts. We may assume that a sloppy reading is derived for any pronoun that is interpreted as a bound variable; other pronouns, which are presumably interpreted as referential expressions, do not yield sloppy readings. Consider (87) and (88).

- (87) every pianist_i loves his_i mother, and every violinist does too
 (88) a. John_i likes his_i mother, and Peter does too
 b. John_i likes his_i mother, and Peter does too

(87) has the sloppy reading, since the pronoun marked in the scope of the subject is interpreted as a bound variable. In (88) there is a choice: the pronoun may either be superscripted by *John*, as in (88a), or remain unsuperscripted, as there is no reason why superscripting should be obligatory in this structure. In the former case, the pronoun is interpreted as a bound variable, yielding a sloppy reading, in the latter case it can only be interpreted as a referential expression, yielding a non-sloppy reading.

While the representations in (88) are quite unexceptional from a syntactic point of view, we may wonder what it means for the interpretation of an LF structure for a referential expression like *John* to be assigned scope, or for a variable to be in the scope of such an expression. We do not believe that it is necessary to adopt a second order perspective on names (as it is customary in Montague grammar), and interpret names as generalized quantifiers for these notions to make sense, although this is certainly a possibility. We may simply adopt the analysis of sloppy identity proposed by Williams (1977a), Reinhart (1983), and others, where the pronoun in (88a) is bound by a lambda operator, and state that the scope of this operator must be equated with the scope of a referential expression that the predicate it constructs operates on. We can make this explicit, in the present context, by saying that the variable bound by

the lambda operator is associated with the referential expression that replaces the variable through lambda conversion. In (88b), the lambda operator then will not be able to bind the pronoun by (79).

Interestingly, our analysis correctly predicts that the Transitivity Effect will not occur with referential expressions: neither (89a) nor (89b) allows a sloppy reading¹¹.

- (89) a. Kennedy's aide volunteered to support him but D'amato's secretary
has not
b. someone in New York hates it, but someone in Los Angeles does not

Since referential expressions do not undergo QR, the antecedents in (89a & b) will not c-command at LF the subjects that contain them at S-Structure, hence will not superscript those subjects to take scope over the pronouns by transitivity. As noted in section 4.1.3., Reinhart's (1983) extension of c-command to specifier positions does not explain the distinction between referential expressions and quantifiers in this respect. Most other authors whose work has been reviewed in the foregoing sections do not discuss sloppy identity.

Let us now review some of the problems attending the approach defended here. Firstly, there are some contexts in which the evidence for or against a Transitivity Effect is inconclusive at best. Consider (9a) once again.

- (9) a. * who_i did you give a picture of t_i to him_i
(90) John introduced every boy_i to his_i future wife

In view of the well-formedness of (90), we should expect the bound variable pronoun in (9a) to be licensed by transitivity. The accounts of bound variable licensing we have discussed that incorporate a transitivity device all predict that (9a) should be well-formed, insofar as the Wh-extraction it features is allowed. By Higginbotham's (1983) analysis, after *a picture of t* moves at LF, its trace c-commands the pronoun and is the foot of the V-chain headed by the trace of *who*, so that the pronoun is accessible to the trace of *who*. By Safir's (1984) analysis, when *a picture of t* moves at LF to a position adjacent to *who*, the two operators will form a Q-chain, the trace of the direct object being the Q-chain variable which by c-commanding the pronoun makes it invisible to the PCOB. Finally, our analysis predicts that the Wh-operator

¹¹ (89a) is cited from Hornstein; & Weinberg; (1990). Reinhart; (1983) suggests that speakers who allow quantifiers to variable-bind pronouns from specifier position, will also allow sloppy readings with referential antecedents in such structures. She cites (i) as an example.

(i) Felix's_i mother thinks he_i's a genius and so does Siegfried's mother

Hornstein; & Weinberg;, however, do allow Transitivity with quantified NPs, but not in (89a). Furthermore, (89b) certainly lacks a sloppy reading.

should be able to take scope over the direct object, which in turn can scope-mark the pronoun under c-command.

While we do not have an explanation to offer for the relative ill-formedness of (9a), there are some indications that (9a) may not be entirely representative as an example. Firstly, Safir (1984:606:fn.3) observes that (91a) is slightly better than (91b), which cannot be licensed by transitivity.

- (91) a. ?? who_i did you convince friends of t_i [to talk to him_i]
 b. ?* who_i did you convince friends of him_i [to talk to t_i]

Furthermore, examples where the pronoun is more deeply embedded than in (9a) are markedly better ((92a) is cited from Rullmann (1988), who attributes it to Jan Koster p.c.):

- (92) a. which man_i did you tell [a sister of t_i] that we hated him_i
 b. who_i did you give a picture of t_i to his_i wife

Both examples in (92) are better than (9a), suggesting that this example does not violate conditions on bound variable licensing, but requires some alternative explanation.

There is a further class of exceptional examples in the literature on weak crossover, for which only Safir (1984), to my mind, has so far provided an interesting explanation. These are the so-called PRO-gate examples (Cf. Higginbotham 1980a):

- (93) a. √ [PRO_i devotion to his_i country] inspires every soldier_i
 b. [s every soldier_i [s [PRO_i devotion to his_i country] inspires t_i]]

Most proposals discussed above rule out (93a), since PRO here is not c-commanded by its quantified antecedent at S-Structure. Safir's (1984) PCOB is not violated at LF (93b), however, since both the trace of *every soldier* and PRO are [-lexical]. Higginbotham's various accounts of weak crossover rule in (93) by stipulation; for example, Higginbotham's (1983) accessibility condition requires only overt pronouns, not PRO, to be accessible to the variable they are dependent upon. Obviously, our present analysis can easily account for (93) in a similar stipulative manner, by restricting the A-position requirement on pronoun superscripting (77) to overt pronouns, allowing PRO to be superscripted from an A-bar position. There is some reason, however, for being distrustful of this approach; not only is it very much ad hoc, its reliance on the assumption that the presence of a PRO subject is crucial to the well-formedness of this example may be not be justified. The relevant empirical generalizations are far from clear-cut. Consider first the rather puzzling contrast in (94):

- (94) a. * the queen's devotion to his_i country inspires every soldier_i
 b. the teacher's writing to his_i father annoyed [every child in the class]_i

(94a), which does not contain a PRO-gate, is generally considered to be quite bad; (94b), however, which is structurally similar, is usually considered to be at least passable (e.g. by Higginbotham 1980a). Reinhart (1983) presents the example in (95) (attributing it to Haj Ross).

- (95) that people hate him_i disturbs every president_i

Although (95) does not contain a PRO-subject, Reinhart considers it to be well-formed (Safir 1984 disagrees). Reinhart suggests that the presence of PRO is not the relevant factor in these examples. Instead, she argues that the well-formedness of (93) and similar cases is due to their containing an experiencer verb: c-command requirements are known to be easily violated in the context of such verbs, as e.g. in (96) (cited from Pesetsky 1987b).

- (96) each other's_i books amazed the men_i

The relevance of the type of predicate can be further demonstrated with the contrast in (97).

- (97) a. * his_i mother loves every boy_i
 b. his_i mother inspires every boy_i

(97b) is reported to be distinctly better than (97a). Reinhart (1983) and Safir (1984) considered the unexplained relaxation of c-command requirements among experiencer verb arguments to be non-syntactic in nature. It has since been argued however (Cf. Pesetsky 1987b, Belletti & Rizzi 1988) that the reconstruction (or connectivity) effect found in the context of such verbs are due to a syntactic movement operation. Belletti & Rizzi claim (on the basis of Italian) that such examples as (96) are derived from D-Structures like (98), where c-command relations are reversed.

- (98) [_S e [_{VP} [_{V'} amaze [each other's_i books]] the men]]

The object moves to the subject position at S-Structure, presumably for reasons of case. Under these assumptions, the pronoun *his* in (97b) is c-commanded by its quantified antecedent at D-Structure.

If we adopt a movement analysis of experiencer verb subjects, our scope marking approach to crossover phenomena can explain the well-formedness of (97b) and the other well-formed examples cited above. In each case the pronoun may be marked in the scope of its antecedent at D-Structure, when it is still c-commanded by the

antecedent occupying an A-position. Note, that adopting the movement analysis still leaves the reconstruction effect unaccounted for in other approaches to bound variable licensing. Safir's PCOB, Koopman & Sportiche's BP, Reinhart's S-Structure c-command requirement, and Higginbotham's accessibility condition are violated by (97b), irrespective of its D-Structure analysis. However, a successful account of the reconstruction effect in (96) may be extendable so as to allow for reconstruction exceptions to these conditions. In any event, neither the PRO-gate approach nor the movement-approach to the well-formedness of (93a) can be considered entirely adequate, in view of the contrast in (94), as well as many other unclear examples (see Safir 1984). Conceivably, both the presence of a PRO subject and the presence of an experiencer verb contribute to well-formedness in these cases.

Finally, there is one problematic aspect of our proposal that deserves attention. In chapter 2 we pointed out that examples like (99), which contain a reflexive pronoun, only have a sloppy reading.

- (99) The prosecutor considered himself the winner, and so did the defense attorney

This is exactly what we expect to find if Reinhart's unification of Binding Conditions and bound variable licensing is correct; since anaphors must be A-bound, they will always be interpreted as bound variables. Given the approach defended here, some other explanation is required. We might perhaps consider the possibility that reflexives (and reciprocals) cannot be interpreted as referential expressions, perhaps due to a lack of Phi-features. We will not further pursue this question here, but leave it for further investigation.

4.2. Donkey Antecedents

In chapter 2 we compared two competing approaches to donkey anaphora. We concluded that the unselective binding approach, while offering better prospects for further research than the E-type approach, is not without its problems. In the present section, we shall discuss the syntactic treatment of the scopal properties of donkey antecedents, on the basis of our findings in chapter 3. In section 4.3. we shall review the weak crossover effects found with donkey anaphors in the light of our findings in the previous section.

The unselective binding mechanism raises a number of questions concerning the scopal interpretation of weak NPs in general, and of weak NPs functioning as donkey antecedents in particular. Firstly, we need to determine in what way the unselective binding of a variable introduced by a weak NP is conditioned by, and compatible with the requirements on the NP's scope that have been imposed by the syntactic theory of scope. In particular, we want to establish which restrictions (if any) the syntactic theory of scope places on the choice of operators in a structure that are eligible as

unselective binders, and what determines the scope assigned to the existential quantifier that is introduced by default, if no unselective binder of a weak NP's variable is present in the structure. Secondly, when a variable introduced by a weak NP is unselectively bound, we need to establish how the scopes of various parts of the weak NP are determined relative to other operators in the structure. The latter question breaks up in two subquestions. We want to determine which operators can take scope over (the interpretation of) the N' that is predicated over a weak NP's unselectively bound variable. Secondly, those unselective binding theories that deal with plural donkey antecedents as well as with singular antecedents also require some way to determine which operators can be interpreted in the scope of a plural weak NP whose variable is unselectively bound. Thirdly, since donkey sentences of the VP-conjunction variety (discussed in chapter 2, sections 2.2., and 2.4.3.1.) cannot be analyzed as cases of unselective binding, weak NPs must be treated in a way that allows for some alternative analysis for these examples. We discussed one possible analysis of these examples in chapter 2, section 2.4.3.2.: we may attempt to employ the default existential closure mechanism to account for VP-conjunction donkey anaphora, by interpreting the weak NP as a predicate over a higher order variable, and allowing the default existential quantifier to take scope over both the VP that contains the antecedent, and the VP that contains the donkey-anaphor, so that it can bind both the variable introduced by the antecedent, and the donkey pronoun. Again, if this analysis is adopted, problems arise as to the scope assigned to the interpretations of various parts of the weak NP, relative to the scope assigned to the default existential quantifier, as we have seen in chapter 2, section 2.4.3.2..

These questions have received comparatively little attention in the literature on donkey anaphora. In the following short subsections, we will discuss the Sigma-sequence approach advocated by May (1985), the proposals by Heim (1982) and Reinhart (1987), and Haïk's (1984) and Heim's (1990) analyses. In the course of our discussion of these proposals we will come across most of the relevant examples and generalizations. We will then propose a Scope Marking analysis in section 4.2.4.. Finally, in section 4.2.5. we will take a brief look at the proportion problem.

4.2.1. Sigma-sequences

May (1985) proposes to explain the conditions on donkey antecedents by means of his Sigma-sequence notion, discussed in chapter 3, section 3.5.1.. We will not discuss May's proposal in full detail, because a cursory description will suffice for us to determine whether it can properly account for the data to be discussed here.

Briefly, May proposes that a quantified NP A may be interpreted as an open sentence containing a free variable unselectively bound by the quantifier in the interpretation of NP B, just in case A and B are members of the same Sigma-sequence. Consider (100) (Cf. May 1985:Ch.3:(39)) as an example.

- (100)a. every owner of a donkey beats it
 b. $[_S [_{NP} \text{a donkey}_i [_{NP} \text{every owner of } t_i]]] [_S t_j \text{ beats it}_i]]$

The NPs *a donkey* and *every owner of t* in the LF (100b) constitute a Sigma-sequence, since each NP governs the other. Therefore, the quantifier that interprets *every* may bind both the variable that interprets the trace in subject position, and the variable that interprets the trace of *a donkey*. In that case, *every* will be interpreted as a quantifier over pairs. The present example will be interpreted as the assertion that every pair of individuals x and y such that y is a donkey and x owns y, is a pair of individuals x and y such that x beats y; this is roughly correct.

One felicitous property of May's analysis is that it correctly predicts that an NP's variable cannot be unselectively bound if at the same time some part of the NP's interpretation is in the scope of some operator lower than the unselective binder. Consider (101) for an example.

- (101)a. every farmer who believes that a donkey is ill will try to cure it
 b. $[_S [_{NP} \text{a donkey}_i [_{NP} \text{every farmer who believes that } t_i \text{ is ill }]]] [_S t_j \text{ will try to cure it}_i]]$
 c. - every $\langle x, y \rangle$ $[[\text{farmer}(x) \ \& \ x \text{ believes that } [\text{donkey}(y) \text{ and ill}(y)]] \rightarrow [x \text{ will try to cure } y]]$
 d. + every $\langle x, y \rangle$ $[[\text{farmer}(x) \ \& \ \text{donkey}(y) \ \& \ x \text{ believes that } [\text{ill}(y)]] \rightarrow [x \text{ will try to cure } y]]$

(101c) says that every farmer for whom there is some individual that he believes to be a donkey that is ill will try to cure that individual. This is not a possible reading for (101a), although logically there is nothing wrong with it¹². Only (101d), which says that every farmer for whom there is an individual that actually is a donkey, and of which he believes it is ill, will try to cure that donkey, represents a reading of (101a). This is predicted by May's theory, since for *believe* in (101b) to have scope over *donkey(y)*, *a donkey* in the LF for (101a) should be adjoined to a position c-commanded by *believe*. But in that case, its variable cannot be unselectively bound by *every*, since it will not constitute a Sigma-sequence with the containing NP. The variable in the interpretation of *a donkey* can be unselectively bound by *every* only if QR adjoins *a donkey* to the complex NP (yielding the LF (101b)), outside the scope of any operators contained in the complex NP. This answers one of the questions we posed in the introduction to section 4.2..

However, May's proposal gives an incorrect answer to a further question formulated above. If weak NPs are available as donkey antecedents only in case they form a Sigma-sequence with the complex NP they are contained in at S-Structure,

¹² In some specialized contexts, similar readings appear to be available, however, e.g. in: *every man who believes that a mermaid lives in his swimming pool wants her to leave*. We will not discuss these examples here; the interested reader is referred to Roberts; (1987).

then we expect plural donkey antecedents to take scope over any other operators contained in the complex NP. Consider (102).

- (102) every farmer who told an inspector that three donkeys he owned had run away was ordered to hunt them down

With some difficulty, the weak NP *three donkeys he owned* in (102) can be understood as an antecedent for *them*. But it is quite impossible for that NP to take scope over *an inspector*, giving a reading where farmers tell different inspectors about each of their three runaway donkeys. Nevertheless, this is a reading we expect the sentence to have if the donkey-antecedent is adjoined to the highest NP-node so as to form a Sigma-sequence with it (we will give some less complicated examples in the next subsection)¹³. From (101) and (102) we may tentatively conclude that donkey antecedents must be interpreted outside the scope of any c-commanding operators lower than the unselective binder, but without (necessarily) taking scope over those operators.

There are two more important reasons why May's proposal must be considered inadequate. Firstly, it does not account for VP-conjunction donkey anaphors. We have seen in chapter 2, section 2.4.3.1. that unselective binding would give incorrect results in such cases (also, unselective binding would be syntactically disallowed under May's assumptions in these cases). But note that May assumes that weak NPs are interpreted as open sentences only in those structures in which their variables may be unselectively bound; elsewhere (e.g. in case a weak NP does not enter into a Sigma-sequence with an NP that contains it at S-Structure), weak NPs are interpreted as normal quantified expressions. Consequently, no mechanism of default existential closure is required. This implies that the potential solution for VP-conjunction donkey anaphora that we considered in chapter 2, section 2.4.3.2. (which makes crucial use of the default existential quantifier) is not an option for May.

Finally, May's analysis of donkey anaphora has some seriously undesirable consequences for the theory of scope. This becomes apparent if we take a closer look at the commonest example of donkey anaphora.

- (103)a. every farmer who owns a donkey beats it
 b. $[_S [_{NP} \text{a donkey}_i [_{NP} \text{every farmer who owns } t_i]]]_j [_S t_j \text{ beats } it_i]]$

By May's assumptions, for the variable of *a donkey* to be unselectively bound, (103a) must have the LF (103b). But in fact we must assume that (103b) is an ill-formed LF, since it violates the CNPC. If *a donkey* in (103) can form a Sigma-sequence with the complex NP that contains it, then we should expect the two NPs to be interpretable in

¹³ We are assuming here that May; intends his analysis to work not only for singular antecedents, but for plural antecedents as well, the quantifier binding a higher order variable in the latter case; this is suggested by his discussion of strong antecedents (May; 1985:76), although he does not discuss the semantic particulars.

any scopal order. Hence, we should expect *a donkey* to be able to take scope over the matrix S in (103). Similarly, we should expect (104b) to be a possible LF for (104a).

- (104)a. a boy who loves every girl is unhappy
 b. $[_S [_{NP} \text{every girl}_i [_{NP} \text{a boy who loves } t_i]]]_j [_S t_j \text{ is unhappy }]]$

Consequently, (104a) should be interpretable as "for every girl *x*, there is a boy who loves *x* and who is unhappy". This (as we have seen in chapter 1, section 1.2.5.) is patently incorrect. Therefore, the LFs in (103b) and (104b) must be ruled out as CNPC violations, so that we are left without an account of the possibility of donkey anaphora in complex NP structures.

4.2.2. Open Sentences

Standard syntactic implementations of the unselective binding mechanism, such as those described in Reinhart (1987) and in chapter 2 of Heim (1982) have paid very little attention to the questions addressed here. Both authors assume that weak NPs undergo QR at LF. In addition, Heim ensures that an operator may unselectively bind only weak NPs in its restrictive clause by assuming that the nuclear scope of a quantifier must undergo default existential closure. Subsequently, a free variable in the interpretation of a weak NP may be unselectively bound by any c-commanding operator. Reinhart assumes a different method of confining unselective binding to an operator's restrictive clause (which does not concern us here), hence does not require nuclear scopes to be existentially closed. Both accounts fail to account for the interpretations of a range of examples where the donkey antecedent is contained in an embedded clause or is otherwise in the domain of some scopal operator.

We noted in chapter 2, that the predictions Heim's (1982) theory makes with respect to the scopal interpretation of donkey antecedents are not easily tested. She restricts attention to singular NPs, and as we have seen in chapters 1 and 3, it is not generally possible to establish whether a singular weak NP has scope over other operators, or is simply scopally independent (Reinhart's work, on the other hand, addresses plural weak NPs as well). Nevertheless, we already noted that Heim's theory does appear to present difficulties for the theory of scope. We can see this by confronting Heim's (and Reinhart's) analysis with some of the specificity data discussed in the previous chapter.

Consider first of all example (105) (repeated from chapter 2).

- (105) Every boy will leave if a redheaded girl of my acquaintance_{*i*} speaks to him. She_{*i*} is really insupportable.

A redheaded girl of my acquaintance in (105) is used specifically; it is interpreted outside the scope of both the conditional clause and the matrix subject. We can draw several conclusions from (105). If the pronoun in the second sentence is to be bound

by an existential quantifier attached to the Text node, which also unselectively binds the variable introduced by the weak NP (as Heim would have to assume in order to account for the cross-sentential anaphora in this discourse), then apparently the nuclear scope of *every boy* (which contains the specific NP) has not undergone existential closure. This argument loses its relevance, of course, if we assume that discourse anaphora should not be treated in this manner, as we have argued in chapter 2, section 2.3. But quite apart from the anaphora question, Heim's assumptions will not allow us to derive the correct semantics for the first sentence in (105) since, as we have seen in chapter 3, to syntactically account for the phenomenon of specificity some additional mechanism besides QR is required. The added option of introducing existential quantifiers at any desired position in a structure is not sufficient for this purpose. If the existential quantifier is inserted inside the *if*-clause, then a non-specific reading is obtained; if the existential takes scope over the *if*-clause, then the interpretation given (roughly) in (106) results (using *redhead* to abbreviate the weak NP's N').

$$(106) \quad \exists y \forall x:\text{boy} [[\text{redhead}(y) \ \& \ \text{speaks_to}(y,x)] \rightarrow \text{leave}(x)]$$

(106) is incorrect, since it says that there is an individual such that every boy will leave if she is a redhead, and speaks to him; (105) says that there is a redheaded girl, such that every boy will leave if she speaks. A correct formula giving the intended reading for (105) might look like (107).

$$(107) \quad \exists y:\text{redhead} \ \forall x:\text{boy} [\text{speaks_to}(y,x) \rightarrow \text{leave}(x)]$$

But in a theory that uses only QR, (107) cannot be derived without extracting the specific NP from the *if*-clause, in violation of the Adjunct Condition. We have seen in chapter 3, that even this is not a solution, since we will then expect the NP to take scope *over* the conditional clause. We can illustrate this if we replace the specific NP in (105) with one that is plural, as in (108) (which brings us to Reinhart (1987)).

$$(108) \quad \text{John has promised to leave if three redheaded girls sitting in the corner ask him to}$$

The relevant observation (which should be familiar by now) is that giving the plural weak NP scope over the conditional clause would result in a reading where John has promised to leave if any one of the three girls in question asks him to. The only available (specific) reading for (108) is, however, that John will leave if the three girls in question all ask him to. The latter reading cannot be derived within Reinhart's framework (and neither, of course, can the former, if QR obeys the Adjunct Condition).

We conclude that Heim's and Reinhart's syntactic accounts of weak NP interpretation cannot be used to describe the specificity phenomenon. This conclusion may not appear very dramatic, or even relevant, in view of the fact that these theories were designed to account for donkey anaphora, not specificity. If some extension must be added to the mechanisms responsible for the interpretation of weak NPs so as to cover the specificity facts, there is no a priori reason why this should bear on the appropriateness of the above-mentioned implementations of unselective binding. However, as we have already seen in the previous subsection, and in chapter 2, section 2.4.3.2., donkey anaphora and specificity in fact are not unrelated matters. If specificity contexts are embedded in contexts of donkey anaphora, it appears that specific NPs may be unselectively bound. Consider (109).

- (109) every professor who will be fired if a (certain) student of his passes
the exam must surely hate him
- (110) John will be fired if a (certain) student of his passes the exam

(109) has a reading where every professor for whom there is a specific student that might cause his dismissal hates that student. In that reading, *a student of his* is specific relative to the conditional clause that contains it, but not relative to the complex NP that contains it; it is unselectively bound by the universal quantifier, and acts as an antecedent to the donkey-anaphor *him*. In other words, the scopal interpretation of the weak NP in (109) relative to the conditional clause is identical to that of the specific NP in (110), except that, instead of being bound by an existential quantifier with scope over the entire clause, it is bound by a universal quantifier in the same position. And as in the case of (110) (comparable to (105) and (108)), the correct semantics for (109) cannot be derived with the syntactic means provided by the authors discussed here. To illustrate, under Reinhart's assumptions (109) would be interpreted as (111) (simplified).

- (111) $\forall \langle x, Y \rangle [[\text{professor}(x) \ \& \ [Y = \{ y \mid \text{student}(y, x) \ \& \ \text{pass}(y) \} \rightarrow \text{fired}(x)]] \rightarrow \text{hate}(x, Y)]$

The truth of (111) requires, for instance, that every professor hates everyone who is not a student who passes the exam.

Finally, as we have seen in chapter 2, section 2.4.3.2., while a higher-order default existential quantifier such as proposed by Reinhart may be employed to account for VP-conjunction donkey anaphora, this will yield incorrect truth conditions unless some carefully devised statement is provided of the scopal properties of various parts of the donkey antecedent; we will not reiterate the argument here, but refer the reader to chapter 2.

In the following short subsection, we will very briefly discuss two more proposed syntactic treatments of donkey antecedents. We will then turn to a scope marking

perspective on these matters in section 4.2.4., where we will provide some more examples of specific donkey antecedents.

4.2.3. Some Other Proposals

In this subsection, we will take a brief look at the unselective binding analysis proposed by Haïk (1984) and at the transformational accommodation approach considered in Heim (1990). This subsection might be of interest primarily to those readers who are familiar with these proposals, and who wish see how they compare with the approach adopted here; otherwise, the reader may safely skip this subsection without detriment to his/her understanding of our analysis.

Haïk (1984) proposes to account for donkey anaphora by means of her "indirect binding" mechanism. We discussed her condition on bound variable pronouns in section 4.1.4., and repeat it here for convenience ((39) = Haïk 1984:(61)).

- (39) a. Pro_i must be c-commanded by NP_i , if NP_i is an inherent quantifier.
 b. $\text{Pro}_{i/j}$ must be c-commanded either by $\text{NP}_{i/j}$ or by $\text{NP}_{j(i)}$ (Indirect Binding).

Indirect binding can arise as a result of the operation of rule (112) (= Haïk 1984:(59)).

- (112) $\text{NP}_i \rightarrow \text{NP}_{i(j)}$ if NP_i has scope over NP_j

Consider (113) for an example.

- (113) [every farmer who_{i(j)} t_{i(j)} owns a donkey_{j/i}]_{i(j)} feeds it_{j/i}

Since the relative pronoun has scope over *a donkey*, the latter receives the index of the former as a slash index, and the former receives the index of the latter in parentheses, by (112). The subject complex-NP, which is coindexed with the relative pronoun, can now indirectly bind the donkey pronoun by the second clause of (39b), so that the structure is licit. Both the donkey antecedent and the pronoun are said to be indirectly bound in this structure.

Unfortunately, Haïk gives very little indication of how she believes donkey pronouns should be interpreted, so that whatever predictions follow from her theory, they cannot easily be tested. Nevertheless, we want to discuss it here because of the family resemblance between her theory and our own (see chapter 3, section 3.5.4. for a comparison).

First of all, it is important to note that (112) introduces an additional mechanism on top of the slash indexing mechanism which, as we shall see below, our theory can do without. Furthermore, there is very little to be gained, I believe, by calling the relation between a wide scope quantifier and a narrow scope quantifier, or the relation between an antecedent-containing clause and a donkey pronoun, relations of indirect

binding, since there is no indication of an actual resemblance between indirect binding, and binding in the sense of the binding theory. Specifically, if indirect binding were an actual binding relation then we would expect (113) to violate both condition B and condition C of the binding theory (as the R-expression *a donkey* is indirectly bound by the trace of *who*, and the pronoun *it* is indirectly bound, within its MGC, by the matrix subject). Therefore, the mechanism as such is highly stipulative.

The indirect binding requirement in (39b) can be viewed as a condition on the syntactic status of the anaphor, or as a syntactic condition on the donkey antecedent.

As a condition on anaphora, the indirect binding part of (39) is sensitive to the same objections that we raised against the direct binding part of (39) as a condition on bound variable pronouns (see section 4.1.4. above). Thus, donkey anaphora displays the same transitivity effect observed with bound pronouns. Example (114) is cited from May (1985:Ch.3:(41)).

- (114) \forall [_{NP1} a friend of [_{NP2} every owner of a donkey_i]] beats it_i

NP2 cannot be an indirect binder here, since it does not c-command the anaphor. NP1 c-commands the anaphor, but cannot be an indirect binder because (112) should not apply to it as it does not have scope over *a donkey* in the intended interpretation. Thus, (114) is incorrectly ruled out.

As a condition on donkey antecedents, (39) has very little to say. Haik's (39) and (112) do not disallow donkey-anaphora in any structure where the clause that contains the donkey-antecedent has scope over it. Thus, donkey anaphora is correctly allowed, e.g., in case the donkey antecedent is further embedded in a conditional clause, as in (109), or (120) below. We cannot decide, however, whether the correct semantics can be derived for such examples (which is where the other proposals discussed in this subsection and the previous one fall short) in the absence of a statement of the interpretation of indirectly bound pronouns, and indirectly bound antecedents.

On the other hand, indirect binding will also be allowed, incorrectly, in case the donkey antecedent is in the scope, not only of the containing NP, but of some further operator as well:

- (114) * [every farmer who_{k(j)(i)} told each of his daughters_{j/k} a story_{i/j/k}]_{k(j)(i)}
enjoyed it_{i/j/k} himself

In (114), if *a story* is interpreted in the scope of *each of his daughters*, the pronoun cannot be interpreted as a donkey pronoun. But the structure does not in fact violate (39), as the pronoun is indirectly bound by the subject NP in compliance with (39b). Note that it will not help to reinterpret (39b) as saying that all indices attached to a pronoun must be bound, since this is also the case in (114): the complex NP is assigned the indices of both embedded NPs in parentheses.

The problem in connection with (114) has not gone unnoticed by Haik. She has added to (39) the stipulation that an indirectly bound pronoun (one that is licensed by the second half of (39b)) must be indirectly bound by all NPs that have scope over its antecedent. This stipulation gives a fair indication of the nature of the problem: the licensing of donkey anaphora appears not to be a matter of (indirect) binding, but a matter of scope, which we must conclude is not the same thing. Note, that the stipulation cannot be rephrased without reference to the notion of scope. We cannot say, for instance, that an indirectly bound pronoun must, for some reason, be indirectly bound by all NPs that indirectly bind its antecedent, since we can construct a variant of (114) where the antecedent is in the scope of some lower operator, but not indirectly bound by it (due to lack of c-command), and such a variant will still disallow donkey anaphora. Thus, the correctness of Haik's treatment of donkey antecedents turns out to have very little to do with indirect binding or with (39), but reduces instead to the correctness of her treatment of scope phenomena in general: we discussed this in chapter 3, section 3.5.4..

It is worthwhile to inspect Haik's analysis of VP-conjunction donkey anaphora:

(115) every farmer_{i(j)} owns some donkeys_{j/i} and feeds them_{j/i} at night

The anaphor is indirectly bound by the subject here, in compliance with (39), so that the structure is correctly ruled in. However, if the indirect binding that obtains between the subject and the pronoun is any indication of the way in which the pronoun will be interpreted, then this result may not be desirable. If indirect binding is interpreted as unselective binding, then we do not want it to obtain here, since unselective binding gives incorrect truth conditions in the VP-conjunction cases.

On the other hand, if we consider (39) as a purely syntactic condition, which correctly licenses the coindexing of the donkey antecedent and the anaphor in (115), then we can now add a further objection to our observations in section 4.1.4.. On the basis of the coindexing between the antecedent and the pronoun in (115), we should expect the pronoun to be interpretable as a straightforward bound variable, rather than a donkey pronoun. In fact, there is no syntactic reason why this should not be possible e.g. in (113), apart from the effects of some version of the Scope Condition. The Scope Condition will not prevent a bound variable reading in (115), however, since by Haik's assumptions the antecedent may take scope over any constituent it S-commands.

Let us turn now to Heim (1990). Having dismissed a situation semantics implementation of E-type pronouns, Heim proposes, almost as an afterthought, a possible transformational approach to donkey anaphora. Although Heim's proposal exists only in rough outline, we can conclude on the basis of our current observations that it is probably not on the right track.

Heim's transformational rule (which, as she points out, is rather similar in its

effects to the accommodation rule proposed in Kadmon (1987), later adapted by Kadmon (1990), Chierchia (1992)) is given in (116) (= Heim 1990:(73)).

- (116) X S Y NP_i Z \Rightarrow 1 2 3 4+2 5
 1 2 3 4 5
 conditions: 4 is a pronoun
 2 is of the form [S NP_i S]
 6 7

This transformation presumes that the donkey antecedent has been adjoined to S by QR; it then adjoins a copy of the antecedent and the clause that it has taken scope over to the donkey pronoun. The effect of this is illustrated in (117) (irrelevant details distorted).

- (117)a. every farmer who owns a donkey_i feeds it_i
 b. every farmer who_j [S a donkey_i [S t_j owns t_i]] beats [it_i [S a donkey_i [S t_j owns t_i]]]

QR and (116) map (117a) onto (117b). (117b) is interpreted roughly as "every farmer who owns a donkey beats the donkey that he owns".

The main problem with this accommodation approach is that it requires QR to adjoin the donkey antecedent to the highest S-node in the relative clause, or else wildly inaccurate interpretations will be derived. This leads to two different types of problems, some of which we encountered earlier in the two previous subsections. Firstly, a donkey antecedent need not always take scope over all other operators in its clause:

- (118) every farmer who an inspector stole two donkeys from wants them back

The most prominent reading for (118) has *an inspector* not in the scope of *two donkeys*. This means that, if *two donkeys* undergoes QR at all, it should be adjoined to a lower S-node than *an inspector*. But this will not yield a correct interpretation: accommodation will then derive (119).

- (119) every farmer who_j [S an inspector_k [S two donkeys_i [S t_k stole t_i from t_j]]] wants [them_i [S two donkeys_i [S t_k stole t_i from t_j]]] back

Since *an inspector* is not in the scope of the donkey-antecedent, it will not be contained in the copied material, which therefore contains the variable *t_k* left by *an inspector* free.

In some cases, restrictions on QR will even prevent the donkey antecedent from

taking scope over the entire relative clause. Consider again an Adjunct Condition example, in (120).

- (120) every boy who threatened to leave if a girlfriend opened her mouth
once more shocked her into silence

QR cannot extract the donkey-antecedent from the conditional clause, but the scope of the antecedent is obviously not restricted to the conditional. This implies that Heim's proposal, which relies crucially on QR to assign the antecedent its proper scope, cannot deal with such examples. In fact it appears that (116) would derive as the interpretation of (120) something similar to (121).

- (121) every boy who threatened to leave if a girlfriend opened her mouth
once more, shocked the girlfriend who opened her mouth once more
into silence

It appears to me that for an accommodation approach to work, it should begin by always copying the entire relative clause that contains the antecedent, irrespective of the position assigned to the antecedent by QR. However, this will leave the problem of how to assign the proper scope to the donkey antecedent's copy in the accommodated constituent unsolved. We will not further pursue this issue here.

4.2.4. Scope Marking

In this section we will present further evidence of Relativized Specificity phenomena occurring in contexts of donkey anaphora, and show how a Scope Marking analysis may be invoked to explain these facts.

Consider first example (122).

- (122) every farmer who an inspector stole two donkeys from wants them
back

As noted in the previous subsection, this example is naturally interpreted with *an inspector* not in the scope of *two donkeys* (i.e. it is naturally understood as a statement about farmers who had two donkeys stolen by one and the same inspector). Nevertheless, if the variable introduced by *two donkeys* is unselectively bound by *every*, then *two donkeys* is also not interpreted in the scope of *an inspector*. Hence, both NPs are scopally independent from each other, and we can say that the object NP is specific relative to the subject NP. We can syntactically account for this by assuming that neither NP carries the other NP's superscript.

Recall from chapter 3 that the reading for (122) noted here appears to allow of an alternative explanation. It may be argued that this reading comes about when *two donkeys* takes scope over the subject, but happens to be interpreted collectively, rather

than distributively. However, this possible alternative does not explain why the 'collective' reading of the weak NP in (122) noted above is much more easily available than the distributive reading (where each donkey was stolen by some, possibly different inspector). We can explain the difference in availability between the 'collective' and the 'distributive' reading of *two donkeys*, if we assume that the former results from its remaining in situ at LF, while being interpreted specifically, whereas the latter should result from QR moving the weak NP to a wide scope position.

Another clear example is given in (123).

- (123) every farmer who [_{VP} [_{VP} lives in Tusca] and [_{VP} owns some donkeys]] hates them

The scope of *some donkeys* in (123) is not restricted to the VP that contains it, since its variable is unselectively bound by *every*. Nevertheless, we have seen in chapter 1, section 1.2.7., that the NP cannot take scope over the conjoined VPs, or it will violate the CSC. Hence, this example requires a relativized specificity analysis. The obligatory non-wide scope of the donkey antecedent in this example can be illustrated with (124).

- (124) every farmer who owns less than three donkeys_i and rents a car as well finds them_i superfluous

Less than three donkeys in this example cannot possibly be interpreted with scope over *a car*, but can nonetheless function as a donkey antecedent to *them*.

Consider also an example with a donkey antecedent embedded in a tensed S, a position from which weak NPs cannot usually take wide matrix scope.

- (125) every farmer who believes that a donkey is ill will try to cure it
As noted earlier in section 4.2.1., *a donkey* must be interpreted outside the scope of *believes* for it to function as an antecedent to *it*.

Turning now to some other extraction islands, the donkey antecedent in (126) is contained in a definite NP:

- (126) every farmer who meets the mother of a girlfriend dumps her immediately

While *a girlfriend* in (126) takes scope outside the definite NP, it does not take scope over it; this is clear from (127), which, for every farmer, must be about one common mother of two girls.

- (127) every farmer who meets the mother of two girlfriends dumps them immediately

More significantly, donkey antecedents may be contained in adjunct clauses, and in complex NPs. The former case is exemplified in (128).

- (128) every professor who will be annoyed if a student of his passes the exam must surely hate him

On its most prominent interpretation, (128) is a statement about professors who have a specific student such that if he passes the exam, the professor will be annoyed. Similarly in (129).

- (129) every boy who threatened to leave if a girlfriend opened her mouth once more shocked her into silence

We cited (130) in chapter 2, where we noted that the scopal order that is pragmatically least plausible, with the scope of *a statue* not restricted to the complex NP, is readily available here.

- (130) every artist who designed every pedestal to mount a statue on surely hates it

Due to the CNPC, *a statue* cannot take scope over the complex NP from its S-Structure position, but relativized specificity apparently does allow it to take scope outside the complex NP. Similarly in (131).

- (131) every student who read each and every book that some author wrote quickly grew sick of him

We can draw several conclusions from the data presented above. First of all, they provide strong evidence to support the reality of the Relativized Specificity phenomenon introduced in the previous chapter. In each of the examples in this subsection, a weak NP is interpreted outside the scope of a c-commanding operator, without taking scope over that operator. In almost all examples in this section, the weak NPs take exceptionally non-narrow scope (exceptional, in that they appear to escape from extraction islands that restrict QR), yet without becoming referential. The last four examples are especially interesting in view of our discussion of Fodor & Sag (1982) in the previous chapter. Recall that according to F&S, weak NPs may take scope outside extraction islands only by becoming referential. In chapter 3, section 3.6., we remained in doubt as to whether weak NPs contained in complex NPs (and, to a lesser degree, those in adjunct clauses), have the option of being interpreted specific relative to the extraction island without becoming referential. We now have evidence that this is indeed a possibility, and that F&S's generalization must be considered incorrect in general.

Furthermore, it appears from these examples that weak NPs functioning as donkey antecedents do not behave differently with respect to the theory of scope than weak NPs in other configurations. This suggests that the properties of weak NPs whose variables are unselectively bound may fall out naturally from the theory developed so far. There remain various possible ways of making the syntactic licensing of unselective binding precise. We will assume here that a weak NP may undergo unselective binding just in case it is in the scope of the constituent that is interpreted as the unselective binder, and of no lower operator. In (132a), for instance, the variable associated with *a donkey* may be unselectively bound by the universal quantifier that interprets the QP *every*, but in (132b) it may not.

- (132)a. [every_i farmer who_j showed everyone_mⁱ a donkey_kⁱ]_j was very proud of it
 b. [every_i farmer who_j showed everyone_m^j a donkey_k^m]_j was very proud of it

A donkey in (132a) is interpreted as specific relative to all other scoped elements (*everyone* in particular), hence may function as a donkey antecedent. In (132b), which is a statement about farmers who possibly show each person a different donkey, donkey anaphora is ruled out.

To see how these assumptions work out, we need to have some working hypothesis on how the LF structures generated by the grammar may be mapped onto semantic representations of some kind. We will take the position on weak NP interpretation that we arrived at in chapter 3, section 3.6. as our starting point, and see how unselective binding can be incorporated in it, while repeating the caveat that the semantics we propose is intended primarily as a means of checking the internal consistency of our syntactic theory of scope, rather than an as interesting theory of semantic interpretation for its own sake.

Recall from chapter 3 that a clause containing a weak NP is interpreted by means of a second order formula, the construction of which is constrained by the distribution of indices in the clause's LF structure. Take (133) as an example.

- (133) every boy_i told most people_jⁱ some lies_kⁱ

Here, *some lies* is specific relative to *most people*, but in the scope of *every boy*. (133) must be interpreted in a way which reflects these relations, roughly as in (134).

- (134) $\forall x [\text{boy}(x) \rightarrow [\exists Y [|Y| \geq 2 \ \& \ Y = \text{Max } Z [Z \subseteq \text{Lies} \ \& \ \text{most people } w [\forall z [z \in Z \rightarrow \text{told}(x, z, w)]]]]]]$

According to (134), each boy may tell a different pack of lies, but each boy has one pack of lies that he tells most people. To arrive at (134) from (133), LF interpretation

should abide roughly by the following constraints. A clause containing a weak NP A of the form $[_{NP} \text{ NUM } N']$, will be interpreted as a formula ϕ which contains a subformula ψ , such that all and only those elements that may take scope over A take scope over ψ in ϕ . ψ in turn has the shape $\exists Y [\text{NUM}(Y) \ \& \ Y = \text{Max } Z [Z \subseteq N' \ \& \ \chi]]$, where NUM interprets NUM and N' interprets the N' contained in A , and Z is free in χ . χ is a formula containing a subformula α , such that all and only those elements that neither take scope over A , nor fall within the scope of A , take scope over α in χ . Finally, α is of the form $\forall z [z \in Z \rightarrow \beta]$, where the universal quantifier takes scope over just those elements (contained in β) that fall within the scope of A , including the predicate that assigns a theta-role to the chain of A .¹⁴ In this way, scopal elements in a structure containing a weak NP are divided into three categories: those that take scope over it, those relative to which it is specific, and those it takes scope over.

The fragment $[\text{NUM}(Y) \ \& \ Y = \text{Max } Z [Z \subseteq N' \ \& \ \chi]]$ in the above we might call the NP-denotation of the weak NP, slightly adapting the terminology of chapter 2. In the normal case, this subformula is existentially closed, as an existential quantifier binding the second order variable associated with the weak NP takes immediate scope over it. We may assume in addition, that just in case the NP-denotation is contained in the restrictive clause of an operator that takes immediate scope over it, the existential closure may be omitted, and the variable may be unselectively bound by this operator instead. This implements the syntactic licensing of unselective binding described above.

Consider first (135) as an example.

- (135)a. every_i farmer who owns some donkeys_jⁱ feeds them_j
 b. $\forall \langle x, Y \rangle [[\text{farmer}(x) \ \& \ [|Y| \geq 2 \ \& \ Y = \text{Max } Z [Z \subseteq \text{Donkeys} \ \& \ [\forall z [z \in Z \rightarrow \text{own}(x, z)]]]]] \rightarrow \text{feed}(x, Y)]$
 c. for every x and Y , such that x is a farmer, and Y is the maximal set of donkeys owned by x , and Y has two or more elements, it is the case that x feeds Y

(135a) will be interpreted as (135b), which allows of the rough paraphrase in (135c), which appears to be correct. Note, firstly, that we still assume (Cf. chapter 2, section 2.3.) that a formula like $\text{feed}(x, Y)$ is short for: $\forall y [y \in Y \rightarrow \text{feed}(x, y)]$.

Consider also (136), which contains a monotone decreasing donkey antecedent:

- (136)a. every_i farmer who owns less than three donkeys_jⁱ feeds them_j
 b. $\forall \langle x, Y \rangle [[\text{farmer}(x) \ \& \ [|Y| < 3 \ \& \ Y = \text{Max } Z [Z \subseteq \text{Donkeys} \ \& \ [\forall z [z \in Z \rightarrow \text{own}(x, z)]]]]] \rightarrow \text{feed}(x, Y)]$

¹⁴ These descriptions of course are not intended to reflect the rules that map LF onto LF'; they merely reflect the constraints placed on this mapping by the scopal information encoded in LF.

Again, correct truth conditions result. The same is true in examples with specific donkey antecedents. Compare (137), which has a specific NP contained in a complex NP, with (131) (repeated), which embeds (137) in a context of donkey anaphora.

- (137)a. John read each and every book that some author wrote
 b. $\exists Y [|Y| \geq 1 \ \& \ Y = \text{Max } Z [Z \subseteq \text{Authors} \ \& \ \forall w [[\text{book}(w) \ \& \ \forall z [z \in Z \rightarrow \text{wrote}(z,w)]] \rightarrow \text{read}(\text{John},w)]]]$
- (131)a. every_i student who read each and every book that some author_jⁱ wrote quickly grew sick of him_j
 b. $\forall \langle x,Y \rangle [[\text{student}(x) \ \& \ [|Y| \geq 1 \ \& \ Y = \text{Max } Z [Z \subseteq \text{Authors} \ \& \ \forall w [[\text{book}(w) \ \& \ \forall z [z \in Z \rightarrow \text{wrote}(z,w)]] \rightarrow \text{read}(x,w)]]]] \rightarrow \text{grew_sick_of}(x,Y)]$

The other examples of relatively specific NPs functioning as donkey antecedents cited in the beginning of this subsection all correctly fall out from our present assumptions in a similar way. In some, especially the last two examples, the alternative interpretation procedure described in chapter 3, section 3.6. in connection with example (184) may be more appropriate; we will not pursue this question here. We conclude, that the relativized specificity perspective allows of a uniform treatment of weak NPs in donkey contexts and elsewhere, and accounts naturally for the scopal conditions on unselective binding and for the scopal interpretation of unselectively bound NPs.

We still need to address one particularly problematic type of example: VP-conjunction donkey anaphora, as exemplified in (138).

- (138) every farmer_i [_{VP} [_{VP} owns less than three donkeys_jⁱ] and [_{VP} feeds them_j at night]]

While *less than three donkeys* cannot take scope over the conjoined VP, it can of course be interpreted specifically with respect to the conjunction operator. In a scope marking theory, the following assumptions to account for the scope in a conjunction structure appear to be the most natural. Any operator whose scope is restricted to one or the other conjoined subformula, is marked in the scope of the conjunction operator (*and* in (138)), or is in its scope by transitivity. For an element to take scope over the conjoined elements, on the other hand, it should take scope over the entire conjunction structure (the highest VP-node in (138)), requiring a movement operation that will usually violate the CSC for any element contained in a conjoined element at S-Structure (Cf. chapter 1, section 1.2.7. for a discussion of this requirement). In (138), the weak NP is scope-marked by the subject, but not by the conjunction operator, hence it is specific relative to the conjunction. This will result in an interpretation as in (139): the conjunction operator relative to which the weak NP is specific is interpreted in the intermediary position, inside the scope of the existential

quantifier that binds the second order variable associated with the weak NP, and with scope over the formula in the scope of the weak NP (the conjunction that interprets *and* and its associated brackets highlighted):

$$(139) \quad \forall x [\text{farmer}(x) \rightarrow \exists Y [|Y| < 3 \ \& \ Y = \text{Max } Z [Z \subseteq \text{donkeys} \ \& \ / \forall z [z \in Z \rightarrow \text{own}(x,z)] \ \& \ \text{feed_at_night}(x,Z) /]]]$$

We first considered a similar solution for these examples in chapter 2, section 2.4.3.2.; this solution had some problems associated with it which caused us to conclude that a carefully considered statement of the scopal properties of VP-conjunction donkey antecedents is needed. These problems do not apply to (139): relativized specificity correctly restricts the scope of the weak NP to the conjunct that contains it, while allowing the existential quantifier to take scope over both conjuncts so as to bind the pronoun in the second conjunct as a variable. Thus, our present assumptions equally allow us to account for donkey anaphora contexts which require unselective binding, and for donkey contexts which do not.

In this section we have left the licensing of donkey anaphors unaddressed; we will turn to this in section 4.3., after some consideration of the 'proportion problem' in the following subsection.

4.2.5. The Proportion Problem

There is one problem associated with the unselective binding approach to donkey anaphora that we have not touched on in chapter 2, since it has no direct bearing on matters of syntax. We want to give it some consideration here, because we believe it can shed some light on the distinction between donkey anaphora and cross-sentential (discourse) anaphora. This problem, known as the 'proportion problem', can be illustrated with (140) (below, we will employ a notation with restricted quantification when dealing with the *most* quantifier; see May (1985) for an extension of Generalized Quantifiers as sets of sets of pairs (rather than individuals), with which unselective binding in such cases may be more properly described).

- (140)a. most farmers who own a donkey feed it
 b. most $\langle x,y \rangle$ (farmer(x) & donkey(y) and (own(x,y)) (feed(x,y)))

An unselective binding analysis along the lines of, for instance, Heim (1982), would arrive at something like (140b) as the interpretation of (140a). This is an incorrect result, since (140b) requires that the majority of farmer/donkey pairs satisfy the condition that the farmer feeds the donkey. (140a), on the other hand, appears to state that the majority of donkey-owning farmers feed their donkeys. Suppose there are five donkey owning farmers, four of which own one donkey each, while the fifth one owns ninety-six donkeys. Then (140b) requires that at least fifty-one farmer/donkey pairs are in a feed-relation, which may involve not more than one farmer; (140a) on the

other hand requires that at least three farmers feed all their donkeys, which may involve as few as three farmer/donkey pairs.¹⁵

It appears that the cause of the proportion problem may be traced to matters having to do with the totality and uniqueness effects (as noted, e.g. by Reinhart 1987). Compare the following examples (repeated from chapter 2).

(141) There lived a man in London. He had a beard.

(142) every farmer who owns a donkey beats it

There is a difference in the anaphoric relations in (141) and (142), in that (142) says that every donkey-owning farmer beats all the donkeys that he owns (not just some of them), whereas (141) says that some man in London had a beard (not necessarily all of them). The same difference obtains if the antecedent is plural as in (143) and (144).

(143) There lived some men in London. They had beards.

(144) every farmer who owns some donkeys beats them

We will say that donkey-contexts display a totality effect, which is absent in contexts of discourse anaphora.

Suppose that, following Heim (1982) a.o., we want to account for the anaphora in both types of examples by assuming that the weak NP is predicated over a variable which is bound by a quantifier that also binds the pronoun as this variable. Then we have a choice as to the nature of the predicate that is applied to the variable by the antecedent. We may choose to say that the value of the variable is some individual, or some set of individuals, who satisfy the description of the antecedent clause; or we may choose to say that the variable refers to all individuals who satisfy that description. Taking (143) and (144) as examples, this will lead to interpretations as in (145a) or (145b), and (146a) or (146b), respectively.

(145)a. $\exists Y \ [[Y \subseteq \{y \mid \text{man}(y) \ \& \ \text{londoner}(y) \} \ \& \ |Y| \geq 2] \ \& \ \text{bearded}(Y)]$

b. $\exists Y \ [[Y = \{y \mid \text{man}(y) \ \& \ \text{londoner}(y) \} \ \& \ |Y| \geq 2] \ \& \ \text{bearded}(Y)]$

(146)a. $\forall \langle x, Y \rangle \ [[\text{farmer}(x) \ \& \ Y \subseteq \{y \mid \text{donkey}(y) \ \& \ \text{own}(x, y) \} \ \& \ |Y| \geq 2] \rightarrow \text{beat}(x, Y)]$

b. $\forall \langle x, Y \rangle \ [[\text{farmer}(x) \ \& \ Y = \{y \mid \text{donkey}(y) \ \& \ \text{own}(x, y) \} \ \& \ |Y| \geq 2] \rightarrow \text{beat}(x, Y)]$

Choosing the latter option will incorrectly lead to a totality effect in the cross-sentential case: (143) for instance will be assigned the interpretation in (145b), which says that there is a set consisting of all men in London, all of whose members have

¹⁵ For further discussion of the proportion problem, the reader is referred to Heim; (1990), Kadmon; (1987), and references cited there.

beards. Therefore, the former, "subset"-option (as in (145a)) is indicated for cross-sentential anaphora. This option is, furthermore, the most natural one if one deals only with singular antecedents, and uses only first-order variables. It is possible to choose the latter, "totality"-option in such a first-order approach, by predicating of the variable in question that its referent is the unique individual which satisfies the relevant description; but this will lead to incorrect 'uniqueness' effects both in the cross-sentential case and in the donkey anaphora case. In Heim (1982), the "subset" option was chosen, leading correctly to the absence of a totality effect with discourse anaphora.

But choosing the "subset" option leads to two types of problems. Firstly, as discussed in chapter 2, section 2.3., it generates incorrect results with non-monotone and monotone-decreasing antecedents; we will not reiterate this argument here. Secondly, we must now ask whether this choice will not, incorrectly, lead to the absence of a totality effect in donkey contexts as well.

It turns out that a totality effect will obtain in donkey-contexts, but at the price of a proportion problem. Consider (146a): it says that for every pair consisting of a farmer, and some (not necessarily all) donkeys that he owns, the farmer beats those donkeys. One such pair, therefore, does not display a totality effect. But since this relation is said to hold of all such possible pairs, every donkey owned by a farmer will eventually be a member of the donkey-set in some such pair, so that the totality effect does, indirectly, obtain.

In this way, the difference between donkey-anaphora and discourse anaphora in the presence vs. absence of a totality effect is attributed to the difference in the quantifiers that do the unselective binding in these cases. In discourse anaphora, no totality effect obtains, because the "subset"-predicated variable is bound by an existential quantifier, instead of a universal quantifier.

However, thus allowing the universal quantifier in (144) to quantify not only over farmers, but over donkeys as well, results in the proportion problem. If the choice of quantifier is allowed to affect the totality/subset effect in this way, then obviously a structure with yet a different quantifier (such as *most*) will present yet a different behavior in this respect. Compare (147):

- (147)a. most farmers who own some donkeys beat them
- b. $\text{most } \langle x, Y \rangle (\text{farmer}(x) \ \& \ Y \subseteq \{y \mid \text{donkey}(y) \ \& \ \text{own}(x,y)\} \ \& \ |Y| \geq 2)$
 $(\text{beat}(x,Y))$
- c. $\text{most } \langle x, Y \rangle (\text{farmer}(x) \ \& \ Y = \{y \mid \text{donkey}(y) \ \& \ \text{own}(x,y)\} \ \& \ |Y| \geq 2)$
 $(\text{beat}(x,Y))$

By taking the subset-choice (147b), we predict that (147a) says that out of the pairs that can be constructed by taking a farmer and some subset of his donkeys with at least two members, the majority will satisfy the VP. Only (147c) gives the correct truth-conditions for (147a).

We conclude, therefore, that the above solution to the difference between donkey anaphora and discourse anaphora is not correct. It appears that in order to avoid the proportion problem while accounting for the totality effect in donkey contexts (and in order to allow a correct uniform treatment of other than monotone increasing antecedents), we must choose the 'totality' option illustrated in (146b) and (147c). We have made this choice in our treatment of weak NP interpretation above (although an adjustment may be required along the lines indicated in chapter 3.6., in our discussion of example (184)). Consequently, discourse anaphora cannot be treated in parallel with donkey anaphora (using unselective variable binding across sentential boundaries) or we will predict a totality effect with discourse anaphora, too. This concurs with our conclusions in chapter 2; treating discourse anaphors as deictic elements appears to be the obvious alternative.

4.3. Donkey Anaphors

We have already noted on several occasions that donkey anaphors are known to behave similarly to bound variable pronouns with respect to the constituent that contains the donkey antecedent, in that they apparently violate a weak crossover restriction in certain structures. In this final section, we will reexamine the analyses of crossover discussed in section 4.1. in the light of these data.

Consider first some of the relevant examples. (148) and (149) (cited from May 1985:Ch.3:(40)) and Haik 1984:(56)), and (150) show that the Scope Condition applies to donkey anaphors: since the pronouns in these examples cannot be in the scope of the antecedent-containing NPs, anaphora is ruled out.

- (148) * your shouting at every owner of a donkey_i frightened it_i
- (149) * everyone who owns a donkey_i came, and Mary bought it_i
- (150) * every farmer who owns a donkey_i feeds it_i, but will it_i grow?

Furthermore, when the container of the antecedent c-commands the anaphor at S-Structure, the structure is licit:

- (151) √ every farmer who owns a donkey_i beats it_i

but, if a donkey anaphor is not c-commanded by the container of its antecedent at the appropriate level of representation, the structure will violate Strong Crossover: ((152) from May 1985:151; (153) = Higginbotham 1983:(78))

- (152) * it_i is beaten by everyone who owns a donkey_i
- (153) * which man who owns a donkey_i does it_i hate

or Weak Crossover: ((154) = Reinhart 1987:(37b))

- (154) * her_i mother visited every knight who courted a lady_i
 (155) * its_i former owner envies every farmer who owns a donkey_i

unless, of course, the structure is licensed by transitivity ((156) = May 1985:Ch.3:(41)).

- (156) √ a friend of every owner of a donkey_i beats it_i
 (157) √ every owner of a donkey_i's mother loves it_i

(157) is awkward, obviously, but not, apparently, a WCO violation.

On the other hand, donkey anaphors in VP-conjunction contexts appear to be licensed without being c-commanded either by the antecedent, or a container of the antecedent.

An account of these facts should explain why the donkey anaphor need not be licensed (S-Structure c-commanded, etc.) by the donkey antecedent itself, and why it must be licensed by the container of the donkey antecedent, except in the VP-conjunction case.

The above examples are not exceptional from the point of view of Chomsky's (1977a) and Higginbotham's (1980a) Leftness Conditions. Since these accounts refer only to the linear position of the antecedent's variable relative to the pronoun, not to the antecedent's degree of embedding at LF, they do not treat donkey antecedents (embedded QNPs that remain embedded at LF) differently than embedded quantifiers that undergo inverse linking. We discussed such examples in sections 4.1.1. and 4.1.2..

Higginbotham's (1980b), (1983) Accessibility Condition accounts correctly for (151) through (157). Focussing again on the more recent paper, in each case the donkey antecedent at LF binds a variable that heads a V-chain whose foot, the variable bound by the container of the antecedent, c-commands the pronoun in the well-formed cases, and fails to c-command the pronoun in the ill-formed examples. Of course, without some further statement of the semantic interpretation of donkey anaphora, we cannot say whether the examples in (148) - (157) will violate the Scope Condition; we must assume such a condition to rule out examples like (158), which are allowed by the Accessibility Condition. Higginbotham does not discuss the semantic treatment of donkey anaphora.

- (158) * some farmer who owns every donkey_i beats it_i

Note, incidentally, that Higginbotham's account is incompatible with our assumption that weak NPs do not undergo QR. If that is the case, then the anaphors are not dependent on variables bound by the antecedents, and all examples in (151) through (157) will be ruled in.

Higginbotham's Accessibility Condition fails, however, to allow for donkey anaphora in VP-conjunction contexts:

- (159) every farmer [_{VP} [_{VP} owns some donkeys_i] and [_{VP} feeds them_i at night]]

In the LF of (159), the pronoun will be dependent upon the variable bound by *some donkeys*, but not c-commanded by it.

Reinhart (1983) does not (and does not attempt to) deal with donkey anaphors. This proposal, which requires an NP to c-command any coindexed pronoun, will rule out all cases of donkey anaphora. The proposal in Reinhart (1987) was specifically designed to include a treatment of donkey anaphora. As a general condition on bound variable pronouns, it states that a pronoun may be interpreted as a variable bound by a node α , iff it is bound by α at S-Structure. Reinhart now assumes that the index of a weak NP in the restrictive term of a QNP, may be copied onto the QP that is the specifier of the QNP, as a slash index. This will result in the indexing exemplified in (160) (the specifier QP also bears the index of the QNP itself as a slash index; this is irrelevant for our discussion).

- (160) [every_{/i/} farmer who owns a donkey_j]_i feeds it_j

Recall from our discussion of Reinhart's work in section 4.1.3. that she claims that anything c-commanded by an NP may also be bound by the NP's specifier. Therefore, the donkey anaphor in (160) is bound by *every*, hence may be interpreted as a variable bound by *every*. Since the weak NP's index copied onto the QP will result in the weak NP's variable being unselectively bound by the QP, the pronoun may be interpreted as the variable associated with the weak NP. A correct unselective binding structure results. This proposal correctly rules out crossover violations in donkey contexts; in (154), for example, the donkey anaphor is not c-commanded at S-Structure by the donkey container, hence may not be bound by its specifier. It also allows binding in the transitivity case (157) (due to the specifier extension to c-command), but fails to do so in the complement transitivity case (158), as was the case with regular variable binding (see section 4.1.3.).

The index copying rule that Reinhart introduces in order to account for binding in donkey contexts, is reminiscent of Haïk's (1984) indirect binding mechanism, and its copying of indices in parentheses. Reinhart's analysis does not appear to be quite as ad hoc as Haïk's, however, since copied indices, instead of remaining uninterpreted, directly give rise to a semantic interpretation with unselective binding. However, this also implies that there can be no index copying in VP conjunction structures, where there is no unselective binding. In (159), therefore, the index of *them* is not copied onto *every*, and anaphora is not licensed in this structure.

Finally, we saw in section 4.1.3. that Reinhart's S-Structure c-command condition

fails to exclude crossover with Wh-operators which may have moved from a non-c-commanding position to a position with c-command over the intended bound variable pronoun at S-Structure. Similarly, this condition improperly allows donkey anaphora in crossover structures when the donkey container is a Wh-phrase: it does not differentiate between (161a) and (161b).

- (161)a. \checkmark which man who owns a donkey_i hates its_i former owner
 b. * which man who owns a donkey_i does its_i former owner hate

We already discussed Haïk's indirect binding mechanism in section 4.2.3. above. This mechanism, which was expressly designed to allow donkey antecedent containing constituents to license donkey anaphors under S-Structure c-command, correctly describes the observations in (148) through (155). Furthermore, unlike most other analyses discussed here, it also allows for VP-conjunction examples:

- (162) every farmer_{i(j)} owns some donkeys_{j/i} and feeds them_{j/i} at night

Since the subject takes scope over *some donkeys*, the latter's referential index is attached to it in parentheses; thereby it can indirectly bind the pronoun in the second conjunct. Haïk's Condition on Variables does not, however, allow for donkey anaphors that are licensed by transitivity, just as it does not allow for regular bound variable pronouns that are licensed by transitivity.

As we remarked already in chapter 2, section 2.4.2.1., Koopman & Sportiche's (1982) Bijection Principle cannot account for the facts under discussion here, and neither can Safir's (1984) PCOB. These proposals do not differentiate between (154)/(155), and well-formed examples of donkey anaphora such as (151). Since a donkey-pronoun is A-bar bound neither by its antecedent (which does not c-command it) nor by its antecedent's container (which is not coindexed with it), it does not syntactically function as a variable, hence cannot violate the BP or the PCOB. Furthermore, the Scope Conditions formulated by these authors, which are syntactic conditions on coindexing, rule out all examples in (148) through (157) indiscriminately, since the pronouns are not syntactically in the scope of their antecedents.

Finally, May's (1985) Path Containment account of crossover rules in all well-formed examples of donkey anaphora discussed here, while excluding the ill-formed examples in (152) through (155):

- (155) * its_i former owner envies every farmer who owns a donkey_i
 (163) * [_{S2} [_{NP2} a donkey_i [_{NP1} every farmer who owns t_i]]_j [_{S1} [_{NP3} its_i former owner] [_{VP} envies t_j]]]
 path(t_j) = { VP, S1, S2 }
 path(its_i) = { NP3, S1, S2, NP2 }

In the LF (163) for (155), the path projected from the trace left by the container of the donkey antecedent improperly overlaps with the path projected from the donkey anaphor. But clearly this account goes through only if we adopt May's assumption that a donkey pronoun is A-bar bound at LF by its antecedent, which is extracted from its containing NP in violation of the CNPC. We have argued in section 4.2.1. that this assumption is not tenable.

In summary, out of the theories of pronominal licensing discussed here, those that disallow bound pronouns only in certain binding configurations (such as the BP, the PCOB and the PCC), will fail to rule out inadmissible cases of donkey anaphora, since the donkey antecedent and its anaphor do not usually stand in a relation of syntactic binding (examples of strong crossover excepted). For the same reason, theories that license bound pronouns only in certain binding configurations (Reinhart 1983, 1987, Haïk 1984) will fail to rule in admissible cases of donkey anaphora, unless some additional grammatical mechanism is devised to extend the notion of binding to these examples. Even then, general problems associated with a binding theory approach to bound variable licensing (such as accounting for the Transitivity Effect) will arise equally with donkey anaphora. Higginbotham's (1980b), (1983) V-chain extension of pronominal licensing under c-command felicitously covers not only the Transitivity Effect, but donkey anaphora as well; it does not, however, permit anaphora in the VP-conjunction case.

The examples (148) - (157) are exactly what we expect to find if we adopt a Scope Theory approach to bound variable licensing (as we proposed in section 4.1.8.), in combination with an unselective binding analysis of donkey anaphora (as we proposed in section 4.2.4.). Since donkey anaphors are not interpreted as variables bound by the donkey antecedent, there is no reason why the anaphor should be licensed by the antecedent through being written in its scope. And if the anaphor is interpreted as a variable bound by the operator in the interpretation of the antecedent-containing NP, then we expect it to be licensed just in case it is written in the scope of that NP, and to behave parallel to regular bound variable pronouns that must be bound by this operator.

In our version of the Theory of Scope, this would be worked out as follows.

(164) [every farmer who owns a donkey_i]_j beats it_i

In accordance with condition (77) (see section 4.1.8.), the pronoun in (164) may be scope marked by the subject, which is a c-commanding category in an A-position. Our Scope Condition (same section) now says that the pronoun, which is coindexed with *a donkey*, may be interpreted as the variable associated with *a donkey*, since it may be interpreted in the scope of the binder of that variable (the universal quantifier associated with the subject NP) by virtue of its scope marking. In the ill-formed examples in (148) - (150) (the scope condition violations) the pronoun may not be superscripted by the donkey container due to lack of c-command. In the ill-formed

examples in (152) - (155) (the crossover violations) the pronoun may not be scope marked by the c-commanding donkey container since it is not in an A-position. The Transitivity examples in (156) and (157) are also licensed in the usual manner.

The VP-conjunction examples are analyzed differently. Since the donkey anaphor is not interpreted as an unselectively bound variable in these structures, but as a variable bound by the wide scope existential quantifier associated with the weak NP, we want to explain why it may be interpreted in the scope of this operator. Consider (165).

(165) every farmer_i owns some donkeys_jⁱ and feeds them_jⁱ at night

The licensing of the bound pronoun by the Theory of Scope in this structure can be attributed to the notion of relativized specificity. While the scope of the universal quantifier associated with the subject NP is determined directly by which categories have been scope-marked by the NP, the scope of the second order existential quantifier associated with *some donkeys* is determined in a more indirect manner, as we have seen in section 4.2.4.. In fact, its scope is specifically restricted only by the constraint that it must be inside the scope of anything that takes scope over *some donkeys*. This means that in (165), it must be in the scope of *every farmer*. Any further constraints on what the existential quantifier may take scope over would have to follow from restrictions placed on the scopes of other elements in the structure, syntactic properties of the formulae LF is mapped onto, and the like. This means that probably the only way for the existential quantifier not to be allowed to take scope over the pronoun would be for the pronoun to fall outside the scope of the universal quantifier. This would presumably rule out the binding of the pronoun by the existential quantifier, since that would require a logic in which scope is not transitive. This case does not arise, however, since the pronoun may be marked in the scope of the universal quantifier in this structure. Hence, since the existential quantifier binds a variable associated with *a donkey*, since *them* is coindexed with *a donkey*, and since the existential quantifier may take scope over the interpretation of *them*, the pronoun may be interpreted as that variable, and the structure is ruled in.

This account, although straightforward in the way it relates VP-conjunction donkey anaphora to relativized specificity, does present us with a technical problem. We want to map (165) onto something like (166).

(166) $\forall x [\text{farmer}(x) \rightarrow \exists Y [|Y| \geq 2 \ \& \ Y = \text{Max } Z [Z \subseteq \text{donkeys} \ \& [\forall z [z \in Z \rightarrow \text{own}(x,z)] \ \& \ \text{feed_at_night}(x,Z)]]]]$

In this formula, the variable associated with *them* is actually not bound by the existential quantifier, but by the Max-operator introduced in chapter 3, section 3.6.. Scopally, there is no problem here, as the scope of the Max-operator derives directly from the scope of the existential quantifier, and it can take scope over the pronoun for

the same reasons the quantifier can. We must ask, however, why the pronoun is interpreted as the variable bound by the Max-operator, rather than the one bound by the quantifier, since both variables are associated with the donkey antecedent. There are various possible ways of settling this matter. One way is to redefine the Max-operator in such a way that (165) is presumed to be interpreted as (167), instead of (166).

$$(167) \quad \forall x [\text{farmer}(x) \rightarrow \exists Y [|Y| \geq 2 \ \& \ \text{Max } Y [Y \subseteq \text{donkeys} \ \& [\forall y [y \in Y \rightarrow \text{own}(x,y)] \ \& \ \text{feed_at_night}(x,Y)]]]]$$

This eliminates the second higher order variable altogether. We now need the following semantics for *Max*:

$$(168) \quad \begin{aligned} & \llbracket \text{Max } X \ \varphi \rrbracket^g = 1 \text{ iff} \\ & \llbracket \varphi \rrbracket^g = 1 \text{ and } \sim \exists \mathbf{W} [\llbracket \varphi \rrbracket^{g[X/\mathbf{W}]} = 1 \ \& \ |\mathbf{W}| > |g(X)|] \end{aligned}$$

Another possible solution, which places the burden on the mapping procedure that maps LF onto LF', rather than on the semantics of LF', would be to add a stipulation to the Scope Condition (79), stating that in case more than one operator is available to bind a pronoun, the lowest operator must be selected. We see no principled way, at present, of deciding between these options, especially since we do not take the Max-operator especially seriously as a semantic device to begin with. We will leave the matter open here.

There is one interesting prediction that follows from our analysis of VP-conjunction donkey anaphora: it explains the weak crossover attenuation that obtains with specific weak NPs, as described in section 2.5. of chapter 2. (169) is an example.

$$(169) \quad \checkmark \text{ their}_i \text{ friends admire [some girls we know]}_i$$

While the weak object NP cannot take scope over the pronoun, it can be interpreted specifically relative to all c-commanding elements. This will allow the existential quantifier to take scope over the entire structure, and to bind the pronoun as a variable.

There is one question which we have left unaddressed in our discussion of Donkey Anaphora in this chapter, although it featured briefly in our discussion of Heim (1982) in chapter 2, section 2.3.. Heim discusses examples of donkey anaphora in conditional clause contexts, as exemplified in (170).

$$(170) \quad \text{if a man}_i \text{ comes in here, he}_i \text{ will trip the switch}$$

On the donkey-reading of (170), Heim assumes (in early chapters) that the pronoun and the variable introduced by the antecedent are both unselectively bound by a

'covert necessity operator'. In our section on Relativized Specificity in chapter 3 (section 3.4.2.), we assumed tentatively that the scope of *a man* may be restricted to the conditional clause by virtue of its being scope-marked by the head of the conditional clause, *if*. To account for the donkey-reading, we appear to have at least three options. We may assume that a covert operator is present in the structure at LF, which scope-marks the pronoun and whose interpretation functions as unselective binder of the variable introduced by *a man*. These assumptions would not appear to generate any unwanted consequences, but neither are they very interesting as a syntactic account of donkey anaphora licensing, in view of the absence of independent syntactic evidence of the presence of a covert operator in this structure. Alternatively, we may assume that no covert operator is present, and that the pronoun is scope-marked by the conditional clause itself, while the donkey antecedent is scope-marked just by the head of the conditional clause. This would allow the variable introduced by *a man* to be unselectively bound by the interpretation of the head of the conditional clause, while the pronoun may be interpreted as being in the scope of a quantifier associated with the conditional clause. In order to derive the donkey-reading, we would then have to assume further that a conditional clause (and its head) may be interpretively associated with a necessity operator similar to the one proposed by Heim, except that it is not present in syntax, but only at a level of interpretation following LF. A third option, obviously, would be to assume that the scopal properties of the unselective binder (perhaps: the necessity operator) in this case are determined entirely through the operation of the interpretive rules, not through any property of LF. Each of these options leave unresolved how the binding of the pronoun by the (covert) necessity operator or by the conditional clause can be syntactically licensed. While a scope theory approach to bound variable licensing appears better suited to deal with this issue than a binding theory approach, we have no firm suggestions to make at this point as to how the licensing procedure might be made precise so as to allow for this case; we will leave these questions for further research.

This matter aside, we conclude that the binding properties of donkey anaphors fall out naturally from our assumptions regarding the interpretation of donkey anaphora and the licensing of bound variable pronouns. While we may expect a donkey pronoun that must be unselectively bound by an operator to be syntactically dependent upon that operator in some manner, it does not appear to be very enlightening to describe this dependence in terms of binding. We do not expect syntactic binding to obtain here, since the operator and the pronoun do not share a referential index (special mechanisms aside), and there is no further evidence of syntactic binding from Binding Theory effects. On the other hand, in view of the intended semantic relation between the donkey anaphor and the donkey container, a statement of the dependence of the former upon the latter in terms of scope appears to be very much to the point.

Furthermore, if the licensing of bound variable pronouns is a matter of scope assignment, we may expect to find exceptional cases, where the pronoun is not c-commanded by or marked in the scope of its operator, in exactly those contexts where the antecedent's scope is determined in an exceptional way, as is the case with specific weak NPs in contexts of VP-conjunction donkey anaphora.