Weak Crossover as a Scope Phenomenon

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This article investigates the proper characterization of the condition that is responsible for weak crossover effects. It argues that the relevant condition belongs to scope theory and that weak crossover arises from the way in which scope is determined in syntax. This implies that weak crossover can occur whenever an operator must take scope over a pronoun, even when the pronoun and the operator are not coindexed and the intended interpretation of the pronoun is not as a variable bound by the operator. It also implies that, when an operator is for some reason assigned scope in an exceptional manner and escapes the usual syntactic restrictions on scope assignment, bound variable licensing will be exceptionally allowed as well.

Keywords: weak crossover, scope, variables, binding

1 Introduction

Consider the examples of strong crossover (SCO) and weak crossover (WCO) in (1).

(1) a.   Who$_i$ t$_i$ likes his$_i$ mother?
    b.   *Who$_i$ does he$_i$ like t$_i$?
    c.   ??Who$_i$ does his$_i$ mother like t$_i$?

In (1a) it is possible for the pronoun to be interpreted as a variable bound by the *wh*-operator, yielding the interpretation 'for which person *x, x* likes *x*'s mother'. In (1b) and (1c) a similar reading is unavailable. At first glance the last two examples resemble (2) (see Chomsky 1977), which also excludes a bound variable reading for the pronoun.

(2) ??Every soldier$_i$ has a gun. But will he$_i$ shoot?

However, (2) is usually given a different treatment than the examples in (1). The operator in (2) does not take scope over the pronoun, so the unavailability of the bound reading in this case may simply be attributed to the fact that, as a matter of logic, operators can only bind variables in their scope. In (1), on the other hand, the operators c-command the pronouns. By current theories of scope assignment, this means that the operators do take scope over the pronouns. The absence

of variable binding in (1b–c) thus appears to reveal that a bound variable pronoun not only must be in the scope of the operator, but also is subject to some additional, presumably syntactic constraint.

The syntactic generalization governing the facts in (1) has often been characterized as follows: pronouns that are coindexed with operators must be locally A-bound, or alternatively, operators must not locally Ā-bind pronouns. Many principles of grammar have been proposed that express this basic generalization. It is well known, however, that this generalization does not cover the full range of relevant examples; various refinements have been introduced to deal with different types of counterexamples. Below, I will discuss several classes of such counterexamples. My investigation of these nonstandard cases will lead to a general conclusion regarding the proper characterization of crossover, which I will outline here.

Most analyses of crossover assume that an operator and a pronoun are subject to WCO only if they are coindexed. For instance, (1b) and (1c) are ill formed only on the intended reading indicated by the indexing subscripts; otherwise, the operator is free to cross over the pronoun. Hence, crossover conditions are usually formulated as applying to *coindexed* operator-pronoun pairs. Such conditions typically make use of notions borrowed from some existing module of grammar that employs the coindexing relation: binding theory or, sometimes, movement theory.[1] In some cases the crossover condition is actually incorporated into binding theory.[2] For ease of reference, I will refer to all such conditions as *binding-theoretic* conditions.

Below, I will present several classes of examples where an operator and a pronoun are not coindexed, but we still find a ''WCO configuration''—in the sense that a particular reading of the sentence is available only if the operator c-commands the pronoun from an A-position, and is unavailable if the operator merely c-commands the pronoun from an Ā-position. I will argue that this is the case whenever that reading depends on the operator's taking scope over the pronoun.

Naturally, one might claim that in all such examples the operator and the pronoun really *are* coindexed. But the question then arises how we can provide independent evidence that a pronoun and an operator bear the same index in a given structure. In the relevant examples the pronoun is not interpreted as a variable bound by the operator: they are not coreferential or ''covalued.'' Nonetheless, one might still claim that some coindexing relation obtains, but that the relevant coindexing relation does not denote coreference or covaluation. Of course, this is a gratuitous move, unless one can demonstrate the presence of these indices by some other means—for instance, by showing that they are visible to Condition A, B, or C of binding theory. I will argue

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[1] Some analyses that return to a movement theory perspective of crossover (see Postal 1971) are May's (1985) path-theoretic account, Ruys's (1994b) analysis that derives WCO from Chomsky's (1993) Shortest Link, and the analysis proposed by Georgopoulos (1991). See Ruys 1992 for a discussion of May 1985 and other references mentioned in the text.

[2] For example, Reinhart 1983, 1987, Koopman and Sportiche 1982, Haïk 1984, Safir 1984, 1996, Stowell, to appear. Some authors, notably Higginbotham (1980, 1983), have described the phenomenon in terms of conditions and relations that are only indirectly related to binding theory (e.g., Higginbotham's Dependence and the associated Accessibility Condition). The problem with such an approach is that it begs the question of why the proposed condition has the properties it is defined to have, and why it applies to the class of relations it is said to apply to. I will return to such binding theory extensions below.

that a WCO configuration sometimes obtains between a pronoun and an operator that are not ''related'' in any way (coreferentiality, binding theory) except that the operator, in the intended reading, takes scope over the pronoun.

I will thus argue that the binding-theoretic approach faces severe empirical inadequacies. I propose instead that the condition responsible for WCO belongs to scope theory: both (1b–c) and (2) reflect a failure on the part of the operator to take scope over the pronoun. I will argue that this view holds the promise of a principled definition of the class of pronoun-operator pairs that are subject to WCO.[3]

So many different ''weak crossover conditions'' have been proposed in the literature that space does not permit me to discuss each of them separately. Indeed, this is not strictly necessary, as I aim to argue against whole classes of weak crossover conditions. The exact way in which my arguments apply to each particular implementation known from the literature must be left for the reader to verify (see, however, footnote 21, and Ruys 1992:chap. 4).

In order to facilitate the discussion, I will formulate two ''straw man'' theories of the kind I will argue against. Two such straw men are needed, as the class of analyses I argue against divides into two separate subclasses that are affected by my arguments in different ways. These straw man theories are stated in (3).

(3) a. *Binding-theoretic licensing principle*
Pronoun B may be interpreted as a variable bound by A only if A A-binds B.
   b. *Binding-theoretic configurational principle*
Pronoun B may not be locally Ā-bound.

Two types of crossover principles are distinguished here, which I will refer to as *licensing* principles and *configurational* principles. Licensing principles, in this sense, state that for a pronoun to be interpretable as a bound variable, it must enter into a licensing relation with *some* (operator) expression at some stage in the derivation. In this manner, the bound variable interpretation is ruled *in* under certain conditions. This category includes the proposals in Higginbotham 1980, 1983 and Reinhart 1976, 1983. The licensing principle (3a) is basically Reinhart's condition. Configurational principles, on the other hand, state that a pronoun may not enter into a given relationship with *any* (operator) expression at a given stage in the derivation. In this manner, structures containing a bound pronoun are ruled *out* under certain conditions. This category includes the proposals in Koopman and Sportiche 1982 and Safir 1984. The configurational principle (3b) is basically Koopman and Sportiche's Bijection Principle.

What the two conditions in (3) have in common is that a pronoun and an operator must obey them, on pain of producing a WCO violation, just in case the pronoun and the operator are

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[3] As for the WCO/SCO distinction, there is disagreement in the literature about whether these phenomena should be given a unified account. Reinhart (1983), for example, excludes (1b) and (1c) with the same condition. The Bijection Principle (Koopman and Sportiche 1982), on the other hand, does not exclude (1b); this example is instead considered to be a Condition C violation. The crossover account to be developed here rules out WCO and SCO in the same way. But SCO configurations presumably display a Condition C effect in addition to the crossover effect. Although nothing hinges on this, I will restrict attention to WCO configurations so as to preempt any interfering Condition C effects.

coindexed. I argue instead that WCO as it obtains in (1), where the pronoun and the operator are coindexed, is just a special case of a more general phenomenon. WCO arises in all cases where an operator needs to take scope over a pronoun, but fails to c-command it from an A-position. Again, for ease of exposition, I will formulate a condition that implements this, although in a very simple way (see section 3 for some discussion of details of implementation).[4]

(4) *Scope Licensing*
    A is syntactically licensed to take scope over B iff
    a. A c-commands B, B an operator; or
    b. A c-commands B from an A-position.

I will briefly illustrate how condition (4) applies to the matters at hand. Clause (4a) recapitulates May's (1977) Scope Principle. It accounts for the ambiguity of (5a) (after Quantifier Raising (QR) *everyone* c-commands *someone* in (5b), or vice versa in (5c)) and for the nonambiguity of (6a) (for *every man x* to take scope over *a woman that x loves,* it must c-command that phrase; hence, QR must violate the Complex NP Constraint in (6b)).

(5) a. Someone loves everyone.
    b. [$_{IP}$ everyone$_j$ [$_{IP}$ someone$_i$ [$_{IP}$ t$_i$ loves t$_j$]]]
    c. [$_{IP}$ someone$_i$ [$_{IP}$ everyone$_j$ [$_{IP}$ t$_i$ loves t$_j$]]]

(6) a.   I know a woman that every man loves.
    b. *[$_{IP}$ every man$_i$ [$_{IP}$ I know [$_{NP}$ a woman [$_{CP}$ that t$_i$ loves]]]]

Clause (4b) is the interesting part of the condition: it is responsible for WCO. Let us see how it accounts for regular examples of WCO.

(7) a.   Everyone$_i$ loves his$_i$ mother.
    b. ??His$_i$ mother loves everyone$_i$.

(8) a.   Who$_i$ t$_i$ loves his$_i$ mother?
    b. ??Who$_i$ does his$_i$ mother love t$_i$?

Assume that for a pronoun B to be interpreted as a variable bound by an operator A, A and B must be coindexed, and A must have scope over B. Then in (7a) *his* may be interpreted as a variable bound by *everyone: everyone* c-commands *his* from an A-position in accordance with (4b), hence may take scope over it. In (7b) *everyone* will c-command *his* from an Ā-position at best (after QR), hence is not licensed to take scope over it by (4b). This prevents a bound variable reading for the pronoun.[5] Similarly, in the well-formed case (8a) the operator *who* may take scope

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[4] Note that (4) is a licensing principle in the sense explicated above. Elsewhere (Ruys, in preparation) I argue that ''weakest crossover'' phenomena (Lasnik and Stowell 1991) indicate that this will ultimately turn out to be the correct approach (see also Hornstein 1995).

[5] Already, issues of implementation present themselves. We must not wind up preventing *everyone* in (7a) from taking scope over the pronoun when it moves to an Ā-position at LF. This question touches on an unresolved issue in the theory of scope. Various facts indicate that scope is determined not only by operator positions at LF, but also by their positions at previous stages in the derivation. Aoun and Li (1989), for example, attempted to solve this problem by allowing their scope principle to refer to trace positions. Elsewhere (Ruys 1992) I have rejected this view (partly for

over the pronoun by clause (4b) since it (or its trace, see footnote 5) c-commands *his* from an A-position, whereas in (8b) the operator is not licensed to take scope over the pronoun, so that the bound variable reading cannot obtain.

How exactly does this account differ from binding-theoretic accounts such as (3)? The present account assumes that for a pronoun B to be interpreted as a variable bound by an operator A, two things are required: A and B must be coindexed, and A must have scope over B. Binding-theoretic accounts assume that A and B must be coindexed, A must have scope over B,[6] and some additional constraint such as (3) must be met. Instead of postulating such an additional constraint that refers to the coindexing relation, the present account describes WCO through a complication in the definition of scope, namely, clause (4b). Binding-theoretic approaches typically employ a much simpler definition of scope taking (e.g., c-command at LF).

In the following section I will review a range of observations that can be argued to support a scope-theoretic approach to WCO. In most cases (sections 2.1–2.4) I will argue that WCO obtains even though there is no binding-theoretic (coindexing) relation between the expressions involved, only a scope relation. In one other case (section 2.5) I will show that where relative scope is exceptionally determined by other factors than the usual c-command condition laid down in (4), so is variable binding; exceptional scope and exceptional variable binding go hand in hand.

2 Five Arguments for a Scope Theory of WCO

2.1 Transitivity

The following well-known paradigm (see Higginbotham 1980) exemplifies what I call in Ruys 1992 the *transitivity* property of bound variable licensing:[7]

    (9) a. [$_\alpha$ Every boy's$_i$ mother] loves him$_i$.
        b. [[Every boy's$_i$ mother's] husband] loves him$_i$.

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reasons also noted in Aoun and Li 1993), proposing instead that licensing in the sense of (4) may take place at any point in the derivation. For the present I will stick to this view. In any case the distinction between (7a) and (7b) remains clear: in (7b) no element of the chain of *everyone* c-commands *his* from an A-position at any stage in the derivation. See section 3 for further discussion, in particular footnote 23.

    [6] As pointed out above, it is natural to assume, be it as a property of syntax or semantics, that a pronoun may only be interpreted as a variable bound by a quantified expression if it is in the scope of that expression. It is important to note that this assumption is not unique to my approach, but is one it has in common with virtually all theories of bound anaphora, including those that attribute WCO to a binding-theoretic principle such as (3). Accounts of bound anaphora generally rely on this (usually tacit) assumption; it is sometimes known as the Scope Condition (Koopman and Sportiche 1982). For instance, (2) is not excluded by any configurational WCO condition like (3b) and is generally attributed to a scope failure. And although the licensing condition (3a) happens to exclude the bound reading in (2), it must (when taken to apply at S-Structure) resort to the Scope Condition to explain the nonambiguity of (i).

    (i) Every man$_i$ loves some painting in his$_i$ house.

See Ruys 1992 for an overview of various WCO hypotheses and their reliance on this Scope Condition.

    As for (i), condition (4) allows *every man* to take scope over the pronoun; but if *some painting in his house* then takes wide scope, scope relations will be contradictory. The reverse holds in *Some piece you want him to will be played by every musician,* where *every musician* may take scope over the subject (by (4a)) but not over the pronoun (by (4b)); hence, the bound reading is excluded.

    [7] Also see Ruys 1992 for a review of previous analyses of the transitivity effect.

(10) a. [$_\alpha$ Which boy's$_i$ mother]$_j$ t$_j$ loves him$_i$?

　　　b. [$_\alpha$ Whose$_i$ mother]$_j$ t$_j$ loves him$_i$?

(11) [$_\alpha$ Someone in every city$_i$] hates it$_i$.

(12) [$_\alpha$ Which picture of which man$_i$]$_j$ t$_j$ pleases him$_i$?

These data indicate that an operator-type expression need not A-bind a pronoun in order to variable-bind it. If the operator is embedded in a larger constituent α, either as a complement or as a specifier, the pronoun may still be interpreted as a bound variable.

　　There are just two provisos. First, of course, the operator must take wide scope with respect to α (presumably by way of inverse linking, as indicated in (9a′)); when the wide scope reading is blocked, as in (13), the bound reading is also blocked for obvious reasons.

　(9) a′. Every boy's$_i$ [t$_i$ mother] loves him$_i$.

(13) ??Every boy's$_i$ best friend, Baden-Powell, loves him$_i$.

　　Second, the transitivity effect occurs only in case α is itself in an A-position and c-commands the pronoun (or, as in (9b), is itself contained in yet a larger constituent that obeys this condition). If the containing constituent α is not in a c-commanding A-position, WCO obtains between it and the pronoun, and variable binding fails.

(14) a. ??His$_i$ father loves [$_\alpha$ every boy's$_i$ mother].

　　　b. ??[$_\alpha$ Whose$_i$ father]$_j$ does his$_i$ mother hate t$_j$?

(15) a. ??Its$_i$ mayor loves [$_\alpha$ someone in every city$_i$].

　　　b. ??[$_\alpha$ Which picture of which man$_i$]$_j$ did his$_i$ agent sell t$_j$?

How can this regularity be explained? Most authors agree that α in (9)–(12) is in some sense acting as a licenser for the bound pronoun *by proxy*. Although the bound pronoun must be licensed by some c-commanding element in an A-position, this need not be the binding operator itself; some other constituent may substitute for the operator.[8] But in none of the examples above is there a binding or coindexing relation between the proxy constituent α and the pronoun. Hence, the pair ⟨α, pronoun⟩ cannot violate or satisfy a WCO condition in terms of coindexing. As a result, the binding-theoretic conditions (3) fail to distinguish the well-formed examples in (9)–(12) from the ill-formed ones in (14)–(15).

　　Binding-theoretic treatments of WCO need to invoke some extension of the notion of coindexing to capture the transitivity effect. But such attempts to incorporate the effect into binding theory are self-defeating, as they must be accompanied by a corresponding revision to exempt the usual binding conditions from transitivity. If binding theory allowed a constituent to act as

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[8] Reinhart (1983, 1987) takes a different approach, denying the relevance of α and claiming that the antecedent itself licenses the pronoun. Specifically, she proposes that B is bound by A only if A c-commands B, or A is the specifier of C, and C meets this condition. This accounts (only) for (9) and (10), but (16) remains a problem.

proxy for a distinct, noncoindexed constituent, we would trivially expect (16a) to be well formed and (16b–c) to be ill formed.[9]

(16) a. *[$_\alpha$ Every boy's$_i$ mother] loves himself$_i$.
    b. [$_\alpha$ Every boy's$_i$ mother] loves him$_i$. (= (9a))
    c. [$_\alpha$ Every boy's$_i$ mother] loves the little rascal$_i$.

Safir (1984), for instance, proposes that in transitivity cases the index of the operator is attached to the index of α, allowing α (or its trace) to A-bind the pronoun in accordance with (3) (the Q-Chain Convention). But these added indices must somehow be rendered invisible for all other purposes: they play no role in the binding conditions, witness (16), nor do they receive the same semantic interpretation as regular indices. The same is true of Higginbotham's (1980, 1983) more straightforward analysis. There, the licensing relation between the antecedent, α, and the pronoun is not one of coindexing (or linking), but one of accessibility through a V-chain, a notion specifically designed to describe such facts. This avoids any unwelcome predictions about (16), but raises the same question as Safir's solution. Both solutions postulate a relation between the antecedent operator and α, and between α and the pronoun, which appears to be both syntactically and semantically vacuous: it merely serves to describe the transitivity effect. If the postulated relation, be it accessibility through a V-chain or index sharing through a Q-chain, is not the familiar coindexing/coreference relation, then what, if anything, does the relation mean, and how can it be independently established?

    In other words, if the transitivity effect observed above is a distinctive property of bound variable licensing, then we are unlikely to be successful in attempting to reduce bound variable licensing to binding theory, which predicts that this effect will not obtain.[10] Instead, it would be preferable to derive the transitivity effect from some component of the grammar that naturally relates α to the antecedent operator and the pronoun. Scope theory is an obvious candidate.

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    [9] Note, incidentally, that the considerations presented here detract from Kayne's (1994) claim that (9) and (10) evidence an adjoined position for specifiers; this claim leaves (16) unexplained, and it makes an unwarranted distinction between (9)–(10) and (11)–(12), which my analysis does not.
    [10] Obviously, we cannot claim that it is strictly impossible to formulate an extension of binding theory that allows for A-binding in the transitivity cases while still deriving the correct judgments in (16). Reinhart (1987), for example, proposes that Condition A states that an anaphor and its antecedent must be contained in the same minimal governing category (MGC). This correctly disallows (16a); a similar reformulation of Condition B will correctly allow (16b). This particular reformulation ran into trouble vis-à-vis example (i),

(i) [$_{S_1}$ I believe [$_{S_2}$ John$_i$ to like himself$_i$]].

where MGC(*John*) = $S_1 \neq S_2$ = MGC(*himself*), but the structure is well formed nevertheless (similarly for Condition B). Also, finding a reformulation of Condition C that distinguishes (iia) from (iib) while maintaining that the direct object is A-bound in both cases will presumably prove more difficult.

(ii) a. *Every boy$_i$ likes the little rascal$_i$.
    b. Every boy's$_i$ mother likes the little rascal$_i$.

    Similar problems arise with Safir's (1984) reformulation of binding theory (see Ruys 1992 for discussion). Nonetheless, the argument cannot be that a descriptively adequate incorporation of conditions on variable binding into binding theory is impossible in principle. But the complex immunizations this would involve are evidence that the conditions on variable binding cannot be shown to be related to, let alone derivable from, the conditions on obligatory coreference and disjoint reference.

In the well-formed examples (9)–(12), clause (4b) allows α to take scope over the pronoun—a prediction that is known to be correct. The antecedent operator in turn may take scope over α by clause (4a) after QR—also a well-known fact.[11] Finally, relations of relative scope are transitive in general, so we expect that the antecedent operator may take scope over the pronoun and nothing bars a bound variable interpretation. In the ill-formed examples (14) and (15), on the other hand, neither the antecedent nor its container α is licensed to take scope over the pronoun. Allowing these judgments to follow from scope theory should therefore be entirely straightforward.

There are various ways of implementing this analysis. One option is to add to (4) a third clause stating that scope is transitive. However, it may be more natural to assume that transitivity of scope follows directly from properties of the semantic component. We need to assume, then, that such inherent properties of the semantic component may license a relative scope ordering when it is not syntactically licensed; we will see another possible example of this below. In any case reducing bound anaphora to scope theory will allow us to explain the observations in this section.

2.2 Donkey Anaphora

Donkey anaphora presents a second example of a syntactic relation that is subject to WCO but that cannot be described in terms of binding or coindexing. Consider the contrast in (17).

(17) a. $[_\alpha$ Every farmer who owns a donkey$_i]$ beats it$_i$.
     b. *Its$_i$ former owner envies $[_\alpha$ every farmer who owns a donkey$_i]$.

The coindexed pair *it – a donkey* cannot satisfy the WCO condition in (17a) and violate it in (17b), given that this condition involves some form of c-command. Instead, as in the case of the transitivity examples discussed above, the contrast appears to be due to some relation between the pronoun and α, the quantified NP containing *a donkey*. In view of the prevalent semantic analyses of donkey anaphora, this is predicted by the scope-theoretic approach to WCO.

A donkey in (17) does not take scope over the pronoun in either example. This must be the case on syntactic grounds, since *a donkey* cannot be extracted from the complex NP that contains it. Furthermore, assigning *a donkey* wide scope so as to allow it to bind the pronoun would not result in the correct semantic representation; *a donkey* is interpreted in the scope of the universal quantifier *every,* inside its restrictive clause. Hence, the scope-theoretic approach predicts, correctly, that the relation between the pronoun and *a donkey* is irrelevant to WCO.

One prevalent analysis of donkey anaphora says that *it* in (17a) is interpreted as a variable that is unselectively bound by the universal quantifier, resulting in a universal quantification over farmer/donkey pairs (see Lewis 1975, Heim 1982, Kamp 1981, Ruys 1992, Kamp and Reyle 1993, and references cited there). Another influential view is that *it* is an ''E-type'' pronoun, which is interpreted roughly as a definite NP equivalent to *the donkey that x owns,* where *x* is a variable bound by *every farmer who owns a donkey* (see Evans 1977, Cooper 1979a, Heim 1990,

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[11] Assuming that α counts as an operator in terms of (4a); see May 1985 for arguments that QR is possible for such expressions.

and references cited there). There is no need to discuss the relative merits of these views here; it is sufficient to note that both types of analysis require the larger constituent α that contains the antecedent to take scope over (the interpretation of) the anaphor, either to bind it as a variable or to bind a variable contained in it. Hence, the scope-theoretic approach to WCO predicts, correctly, that the pair $\langle \alpha, \text{pronoun} \rangle$ is subject to the WCO condition.

The requirement that the containing constituent must have scope over the pronoun is confirmed by the absence of donkey anaphora in (18a) (May 1985:chap. 3, (40)), (18b) (Hark 1984: (56)), and (18c), and by the absence of scope ambiguity in (18d).

(18) a. *Your shouting at every owner of a donkey$_i$ frightened it$_i$.
b. *Everyone who owns a donkey$_i$ came, and Mary bought it$_i$.
c. *Every farmer who owns a donkey$_i$ feeds it$_i$, but will it$_i$ grow?
d. Every farmer who owns a donkey$_i$ hates some of its$_i$ habits.

Inspection of the syntactic contexts that allow donkey anaphora shows that the anaphor and the container of its antecedent must meet the WCO condition exactly. (19) (Reinhart 1987:(37b)) and (17b) violate WCO.

(19) *Her$_i$ mother visited every knight who courted a lady$_i$.

The same is true in case the container is a *wh*-element, as the contrast in (20) shows.

(20) a. 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?

And again, we find the transitivity effect, in (21a) (May 1985:chap. 3, (41)) and (21b).

(21) a. A friend of every owner of a donkey$_i$ beats it$_i$.
b. Someone in every city with a cathedral$_i$ hates it$_i$.

There is of course no syntactic binding relation between the donkey anaphor and the container α of its antecedent. Consequently, binding-based licensing theories of bound anaphora (3a) would indiscriminately rule out all examples cited above, and binding-based configurational conditions (3b) would rule them all in (except (18), given the Scope Condition; see footnote 6). Again, as in the case of the transitivity effect, binding-based theories of bound anaphora have been augmented with index-copying mechanisms that induce some type of binding relation between the pronoun and the antecedent-containing constituent (see, e.g., Hark 1984, Reinhart 1987). But this cannot lead to a real unification of binding and bound variable licensing, as these additional mechanisms must be voided of any possible effects other than those needed for bound variable licensing, or we would expect (17a) and (22a) to be ill formed, and (22b) to be well formed.[12]

(22) a. Every farmer who owns a donkey$_i$ beats the stupid animal$_i$.
b. *Every farmer who owns a donkey$_i$ beats itself$_i$.

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[12] See Ruys 1992 for a review of previous analyses of WCO with donkey anaphora.

Although there is no syntactic binding between the donkey anaphor and its licenser, there can be little doubt in view of the semantics of these constructions that the container of the *donkey* antecedent must be able to take scope over the anaphor for donkey anaphora to be possible (as confirmed by (18)). Hence, my reduction of bound variable licensing to scope theory predicts the well-formedness of (17a), (20a), and (21), and the WCO effect in (17b), (19), and (20b) on a par with normal cases of bound anaphora. The implementation of this reduction in (4) applies straightforwardly: in the well-formed examples the licenser α c-commands the pronoun from an A-position in conformity with (4b); in the ill-formed examples it fails to do so.

2.3 Pronouns of Laziness

We have two more classes of examples to discuss where WCO obtains in a structure that involves scope dependency, but not coindexing. This section deals with pronouns of laziness, exemplified in (23).

(23) The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress.

(23) is a paycheck sentence (see Karttunen 1969), with a reading for *it* as a pronoun of laziness; on this reading *it* is interpreted just as a copy of *his paycheck.*

To set the stage, consider first some examples of sloppy identity in VP-deletion contexts. It is well known that sloppy identity requires that the pronoun in the antecedent clause be interpreted as a bound variable.

(24) a. John loves his mother, and Peter does too [$_{VP}$ e].
    b. The woman who emulated Harry believes he is intelligent and the woman who emulated Bill does too [$_{VP}$ e].

(24a) allows a sloppy reading (Peter loves his own mother), but (24b) does not, because (the λ-operator associated with) *Harry* cannot variable-bind *he* (Lasnik 1976). Variable binding in these constructions obeys the usual WCO conditions (Reinhart 1983).

The same conditions hold for the antecedent of a pronoun of laziness; a pronoun can be a pronoun of laziness only if the pronoun contained in its antecedent can in turn be interpreted as a bound variable.

(25) a. Every boy under ten loves his cousin, and every boy over ten wants to marry her.
    b. His cousin loves every boy under ten, and every boy over ten wants to marry her.
    c. When every boy was at school I talked about his cousin, and every boy bought her flowers.

This explains why (25a) is a paycheck sentence, but (25b–c) are not; that would require variable binding into the antecedent *his cousin,* violating WCO in (25b) and the Scope Condition (see footnote 6) in (25c).

So far there is little to indicate whether the structural relation needed for sloppiness is more like binding or scope. Things change when we observe that the conditions on variable licensing

must be met not only in the antecedent for a pronoun of laziness, but also in the copy. Consider (26) and (27).

(26) Every boy under ten loves his cousin, but because every boy over ten is so mature, she is unpopular.

(27) a. Every boy under ten loves his cousin, but she hates every boy over ten.
b. Every boy under ten loves his cousin, but her husband hates every boy over ten.

In (25b–c) the antecedent fails to meet the conditions on bound variable licensing. In (26) and (27), however, only the intended pronoun of laziness fails to meet these conditions, and yet these examples do not allow a laziness reading (*she, her* can only be deictic). In (26) *every boy over ten* cannot take scope out of the adjunct clause; (27a–b) reveal a crossover effect.

The following examples show that the transitivity effect occurs with pronouns of laziness as well, both in the antecedent clause and in the clause containing the pronoun of laziness:

(28) a. Every boy's mother loves his girlfriends, and every boy's father hates them.
b. Someone in every Italian city hates its cathedrals, and someone in every American city loves them.

It appears, then, that the configuration required for bound variable licensing must hold between the pronoun of laziness itself and the expression that is interpreted as binding a variable in the interpretation of the pronoun—call that expression the *licenser* (i.e., between *she/her* and *every boy over ten* in (25), (26), and (27)). Obviously, this requirement cannot be stated in terms of binding theory, as none of the expressions involved are ever coindexed. At best, there is a binding relation at a semantic level of representation between the interpretation of the licenser and a variable properly contained in the interpretation of the licensee.

Assume for concreteness, following Cooper (1979a), that a pronoun of laziness is interpreted as (29),

(29) $\lambda K \; \exists z \; (\forall y \; [S(y)(u) \leftrightarrow z = y] \wedge K(z))$

which reads, roughly, '(the generalized quantifier corresponding to) the unique object that u has the relation S with' (where, in (25a), S refers to the relation *being cousin of,* and the variable u is bound by the quantifier that is the interpretation of the licenser, i.e., *every boy over ten*). It is obvious that if the correct interpretation of pronouns of laziness is even remotely like this, the licenser must take scope over the pronoun of laziness (as confirmed by (26)), namely, in order to bind the variable u. Hence, (4) explains the observations discussed above. But the variable u is not present in the syntactic representation, so that there can be no configurational or licensing condition in terms of syntactic binding or coindexing that makes any distinction between the well-formed and ill-formed examples cited above, other than through some extension of binding theory for which there is no independent evidence outside the domain of crossover effects.

2.4 Non-NP Dependencies

A final, striking case of a WCO-sensitive dependency not reducible to binding is found with determiners such as *another*.

(30) Every student$_i$ kissed another$_{(i)}$ student.

In (30) *another* is interpretively dependent upon *every student,* in that for each choice of a kissing student *x,* the student being kissed must not equal *x* (I have indicated the dependency with a parenthesized index). The dependency involved can be clearly perceived by noting the ambiguity of *Every female student saw every male student kiss another student,* where the student being kissed systematically differs either from the male student or from the female student.

As shown in (31), the dependent element must be in the scope of the quantifier it is dependent upon. Also, as observed in Barwise 1987, the dependency is sensitive to crossover. This is shown in (32).

(31) a. ??John kissed every student$_i$, which annoyed another$_{(i)}$ student.
   b.   Every student$_i$ kissed some other$_{(i)}$ student.

(32) ??Another$_{(i)}$ student kissed every student$_i$.

Sentence (32) only has a reading where the kissing student differs from some contextually determined student. The same holds for (31a); (31b) has the dependent reading, but only with narrow scope for the object.

The transitivity effect applies as expected.

(33) Each girl's$_i$ boyfriend took another$_{(i)}$ girl home.

None of these observations can be stated in terms of binding theory. First of all, the dependent element is a determiner, possibly an adjective, but not an NP subject to binding in terms of binding theory. And even if the NP modified with *another* were considered the dependent element, we would need a counterindexing mechanism in this case, not the coindexing mechanism needed in previous examples.

Similar remarks hold for other types of dependency discussed in Barwise 1987.

(34) a.   Every linguist is in awe of a taller linguist.
   b.   ??A taller linguist contradicted every linguist.
   c.   ??Because every linguist presented a paper, a taller linguist became angry.

Again, the interpretation of *taller* can depend on the interpretation of the element with wider scope. The availability of the dependent interpretation is subject to the conditions that determine relative scope: WCO in (34b), the Adjunct Condition that constrains QR in (34c). Deriving these data from some version of binding theory would be less than straightforward. The relevance of scope theory is unmistakable; we merely need to find a suitable characterization of the syntactic conditions on relative scope in order to derive the observations in this section. Assuming that *another* and *taller* are not operators in the sense of (4a) may be sufficient.[13]

In this section and in sections 2.1–2.3 I have presented examples where a WCO effect is

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[13] Similar effects obtain with expressions such as *the nearest, the local, similar, opposite, different* (Partee 1989), *something else* (Culicover and Jackendoff 1995); see also Carlson 1987, Keenan 1988, Chierchia 1995 for relevant examples. See especially Partee 1989 for arguments that no hidden pronoun is present in these expressions.

found, or found to be absent, although binding-based theories of WCO would positively predict the opposite. In each case we saw that the structural requirements relevant to WCO were being met, or failed to be met, by pairs of constituents that were not related in binding-theoretic terms. Rather than complicating binding theory in order to circumvent its predictions, I have proposed that WCO be recognized as a failed scope relation, as scope theory is obviously relevant in all these cases.

2.5 Exceptional Scope

In this section I will consider arguments supporting my thesis that have a rather different logical structure than used so far. Briefly, consider an operator whose scope is not subject to condition (4): its scope is not determined in syntax in the usual way, but follows from some exceptional syntactic or semantic rule. Suppose further that, binding-theoretically, there is no indication that this operator behaves exceptionally—its anaphor-binding capacity, for instance, is unexceptional. Our expectation is that this operator will also show exceptional variable-binding properties, since the ability to variable-bind depends solely on the ability to take scope. A binding-theoretic licensing condition such as (3a), on the other hand, predicts that, because scope taking is not a sufficient condition for variable binding, this operator will not exceptionally license bound variables.

In this section I will discuss two potential arguments of this type very briefly, and a third in some detail. Consider first the examples in (35).

(35) a.   As each soldier appeared on the platform, a flag was hoisted and a gun went off.
     b.   As every soldier appeared on the platform, a flag was hoisted and a gun went off.
     c.   As each soldier$_i$ came into the room, he$_i$ was given a gun.
     d. ??As every soldier$_i$ came into the room, he$_i$ was given a gun.

In (35a) and (35c) *each soldier* may take scope over the entire sentence, whereas the scope of *every soldier* in (35b) and (35d) is restricted to the adjunct clause in accordance with conditions on movement. (35a) thus illustrates the well-known fact that NPs specified by the QP *each* can take exceptionally wide scope, in apparent violation of locality constraints. For some unknown reason, the scope of such NPs is not subject to condition (4). Example (35c) then shows that the exceptionality of *each* in terms of scope assignment carries over to the variable-binding properties of NPs specified with *each*. The contrast between (35c) and (35d) is as expected, provided that variable binding depends only upon the operator's being able to take scope over the pronoun. But if one supposes that variable binding requires a binding-theoretic licensing relation, such as A-binding, in addition to the scope requirement, then the contrast is unexpected, since there is no evidence that *each* is exceptional in terms of binding theory. The conditions under which *each N* can bind an anaphor, for instance, do not differ from the conditions that allow *every N* to do so.[14]

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[14] Note that this line of reasoning argues only against a licensing condition (3a), not against a configurational condition (3b): *each soldier* in (35c) does not Ā-bind *he* at any level, so the condition is not violated; the same holds for the other structures discussed in this section. Nonetheless, I believe that this detracts only slightly from the importance of the present argument type, as licensing conditions are the more promising WCO conditions (cf. footnote 4).

A second example with the required properties might be the VP-conjunction donkey anaphora structure (36).

(36) Every farmer [$_{VP}$[$_{VP}$ owns some donkeys$_i$] and [$_{VP}$ feeds them$_i$ at night]].

The indefinite *some donkeys* in (36) does not A-bind the pronoun *them;* indeed, it does not c-command *them* at any syntactic level of representation. By condition (3a), we would expect *them* not to be interpretable as a bound variable, as it is not bound, let alone A-bound, by any syntactic expression at any level. Presumably, it is bound by a default existential closure operator associated with *some donkeys.* As such an operator is not a syntactic object, its scope is not determined by syntactic constraints such as (4), so that it is free to take scope over, hence, by my reasoning, to bind the pronoun (see Heim 1982, Kamp and Reyle 1993, Ruys 1992, to appear, for further discussion).

I will consider a final example of this type in some detail. Examples like (37) have been discussed by, for example, Geach (1962), Cooper (1979b), and Hornstein (1984).

(37) a. [$_{NP}$ The woman that every Englishman$_i$ loves most] is his$_i$ mother.
     b. [$_{NP}$ The animal that every Englishman$_i$ cherishes most] is his$_i$ own dog.

These examples are remarkable in several respects. First, the quantified NP *every Englishman* seems to take scope over the complex NP that contains it, although the Complex NP Constraint and other constraints should prevent it from moving out of this NP. Second, *every Englishman* in (37a) can bind the pronoun *his* as a variable, although it does not c-command the pronoun from an A-position. But not only do exceptional scope and exceptional variable binding cooccur in this construction, it is also exceptional from a binding-theoretic point of view. In (37b) *his own,* presumably an anaphor (see Higginbotham 1985:fn. 28), is coindexed only with *every Englishman,* which does not A-bind it, but the structure is well formed nonetheless.

Hornstein (1984) proposes that the well-formedness of (37a) be viewed as the result of a reconstruction process presumed operative in copula constructions. A similar analysis, suggested earlier by Cooper (1979b), proposes that the reconstruction effect in (37) could be reduced to the connectedness effect found in pseudocleft constructions. These authors claimed that, when the copula *be* is replaced with a lexical verb, binding is no longer possible. (38a) is from Hornstein 1984, (38b) from Cooper 1979b.

(38) a. *[$_{NP}$ The woman that every Englishman$_i$ likes] kissed his$_i$ mother.
     b. *[$_{NP}$ The animal every Englishman$_i$ cherishes] hates his$_i$ own dog.

If exceptional variable binding correlates both with exceptional scope assignment and with exceptional A-binding in (37), then this construction does not offer any prima facie evidence about whether variable binding is dependent upon scope or A-binding. And the reconstruction hypothesis does not decide this issue, since both A-binding and scope assignment can be shown to be affected by reconstruction processes.

Nevertheless, I believe that whatever the value of Hornstein's and Cooper's proposals, and whatever the ultimate explanation of (37b), examples of this type can be used to justify reducing

bound variable licensing to scope theory. In noncopula constructions the observed three-way exceptionality breaks down. In such constructions exceptional A-binding is no longer possible. But in many cases (unlike (38a)) scope assignment remains exceptional, and bound variable licensing then sides with scope assignment, not with A-binding. This can be concluded from the examples in (39).

(39) a. [$_{NP}$ The man who builds each television set$_i$] also repairs it$_i$/*itself$_i$.
  b. [$_{NP}$ The very woman that every boy$_i$ loved most] came out to save him$_i$; Wonderwoman came out to save Bill, Spiderwoman came to save Peter, . . .
  c. [$_{NP}$ The woman that every Englishman$_i$ loves most of all] loves him$_i$/*himself$_i$ least of all.

In each of these cases the universally quantified NP takes scope over the entire sentence in spite of the Complex NP Constraint, and it variable-binds the pronoun although A-binding is impossible.[15] Although the wide scope readings may be somewhat marginal in these examples, the point is that, when a wide scope reading is obtained, variable binding is possible as well. This confirms my central hypothesis.

This conclusion would be strengthened if a plausible explanation were provided for the exceptionality of this construction, from which its interpretive properties could be made to follow. Such an explanation might run roughly as follows.

Observe that in (37) and (39) the values assigned to the complex NP are a function of the values assigned to the universal quantifier. (37a), for instance, is interpreted such that for every Englishman *x,* there is exactly one woman that *x* loves most. Now suppose that in semantics, a quantifier contained in an NP may be given scope over that NP (even if this is not syntactically licensed) in case the NP is then interpreted as just such a function. Other factors in (37) and (39) all conspire to bring a functional interpretation about; this would then be enough to trigger a rule of exceptional scope inversion in semantics. The factors contributing to the functional interpretation in (37) and (39) include the use of *most* and, in particular, the use of the definite article.[16]

If this assumption is correct, the possibility of variable binding in these examples follows: the universal quantifier is assigned scope over the complex NP, which in turn is syntactically licensed by (4b) to take scope over the pronoun; the universal quantifier then takes scope over the pronoun by transitivity (see section 2.1), which is sufficient to allow a bound variable reading.[17]

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[15] (39a), taken from Cooper 1979b, is slightly better than the others, presumably because it combines a structure of the type discussed here with the use of the QP *each,* which in itself has exceptional scope properties (see the beginning of this section). For more sophisticated analysis of these examples see Sharvit 1999, which unfortunately was not available at the time this article was written.

[16] See Lobner 1985 for a plausible argument that nouns specified with the definite article are always interpreted as functions.

[17] There is the expected contrast between (37) and (i).

  (i) ??His$_i$ mother hates [$_\alpha$ the woman that every boy$_i$ loves most of all].

The ill-formedness of (i) can be explained as follows. Even if *every boy* may take scope over the NP α that contains it, it may not thereby take scope over *his* since α is not licensed to take scope over *his,* so that transitivity does not provide the necessary scope relations.

My analysis in terms of exceptional scope assignment does not preclude, of course, that connectedness does play a

This hypothesis correctly predicts that the wide scope reading is blocked in case we remove the superlative and the definite determiner (and other relevant factors). The complex NPs in (40) could not be interpreted as functions even if the embedded universal quantifiers were given wide scope; hence, the wide scope reading is not available.

(40) a.   ?[$_{NP}$ Some man who admires each television set$_i$] describes it$_i$ to his wife.
     b.   ??[$_{NP}$ Some woman that every boy$_i$ loved] came out to save him$_i$.
     c.   ??[$_{NP}$ A woman that every Englishman$_i$ loves] loves him$_i$ as well.

My nonsyntactic approach to the wide scope readings in (39) is more plausible than a syntactic approach would be for various reasons. The likelihood of a functional interpretation partly depends on the interaction of idiosyncratic properties of lexical items; it is highly unlikely that their combined influence upon scope assignment (if that is indeed the correct observation) could be explained in syntactic terms. A syntactic explanation for the contrast between (39) and (40) is all the more unlikely because replacing the definite article with the indefinite article should, if anything, make extraction of the quantifier out of the complex NP easier.[18] If the wide scope reading in (39) were due to QR, we should expect this reading to become more easily available in (40), instead of being ruled out.

The functional scope assignment hypothesis proposed here has the added advantage of possibly providing some insight into hitherto ill-understood restrictions on inverse linking. Consider (41).[19]

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role when the copula is present. But Cooper's and Hornstein's connectedness analysis is less than plausible because it does not explain the well-formedness of (ii), where *every Englishman* does not c-command the gap indirectly associated with *his mother,* but variable binding is possible nonetheless. Similarly in (iii).

   (ii) The woman that t loves every Englishman$_i$ most is his$_i$ mother.

   (iii) The man that t interviewed every president$_i$ insulted him$_i$.

A further argument against the connectedness analysis might be based on (iv).

   (iv) His$_i$ mother is the woman that every Englishman$_i$ likes t best.

(iv) is well formed, but only with contrastive stress on *his mother.* Supposing that this indicates movement of *his mother* from the predicate position of the copula (of the type discussed in, e.g., Emonds 1976:34–40, Hoekstra and Mulder 1990), we can explain this as follows. When *his mother* is the subject, the pronoun cannot be marked in the scope of the complex NP *the woman that every Englishman likes best;* hence, *every Englishman* cannot take scope over the pronoun by transitivity. If *his mother* originates from a position c-commanded by the complex NP in subject position, the latter can take scope over the pronoun and variable binding is fine by transitivity. A binding-theoretic condition on variable binding that invokes connectedness to explain the data in this section cannot make this distinction since *his mother* is connected to the trace position in the complex NP under either analysis.

Finally, note that, even if the bound variables in (37) are licensed through reconstruction, this alone does not explain the bound variable reading. It must still be assumed that these examples show exceptional scope assignment (of the embedded quantifier over the complex NP) as well, since this scope relation is at least a necessary condition for variable binding under any analysis.

[18] Because of the Specificity Constraint on movement. See Chomsky 1973, Fiengo and Higginbotham 1981.

[19] These data and their relevance were pointed out to me by Tanya Reinhart.

(41) a.   Someone in every city$_i$ hates it$_i$.
    b. ??An owner of [every car in the street]$_i$ should tow it$_i$ in the morning.
    c.   The owner of [every car in the street]$_i$ should tow it$_i$ in the morning.

Although inverse linking and variable binding are possible in the well-known case (41a), they are not in the superficially similar case (41b). Although I have no suggestions to offer about why this noun-complement case should be worse than the noun-adjunct case,[20] we can now understand the otherwise puzzling fact that (41b) can be improved by replacing the indefinite article with the definite article, as in (41c). In (41c) the subject NP will be interpreted as a function of its internal argument; hence the option of exceptional ''inverse linking'' in semantics, and concomitant variable binding. Note again that we can hardly suppose the distinction between (41b) and (41c) to be due to restrictions on syntactic movement. We would then expect the definite article in (41c) to make extraction of the quantifier less acceptable, not more acceptable, owing to the Specificity Constraint.

    In conclusion, the data in (39) indicate first of all, from a relatively pretheoretical viewpoint, that variable binding derives from scope theory, not from binding theory. In addition, if my suggestions regarding the proper theoretical characterization of the exceptional scope assignment phenomenon discussed in this section are at all plausible, the bound variable readings observed can be derived from my theoretical assumptions. Then, not only do (37) and (39) show that scope may be assigned in other ways than on the basis of (4), thereby evading (4b) and permitting exceptional variable binding, but we may also begin to understand why (4) can be circumvented in these examples.

2.6 Conclusions

In this section I have argued that the single requirement that must be met for a pronoun to be interpretable as a variable bound by a coindexed operator is that the operator must be interpreted with scope over the pronoun. I have also argued that for a quantifier to take scope over a pronoun, it must meet stricter conditions than for it to take scope over, say, another quantifier. Specifically, I have assumed that the quantifier must c-command the pronoun from an A-position (at some stage in the derivation). This restriction explains the WCO effect.

    Various predictions follow. First, pronouns that are not interpreted as variables bound by a quantifier Q may nevertheless show a WCO effect relative to Q if they are interpreted as scopally dependent upon Q in some other way (the pronouns of laziness of section 2.3 and, under some analyses, the donkey anaphors of section 2.2). Also, extending the A-c-command requirement to other lexical categories explains the WCO effect with nonpronouns (section 2.4).

    Second, although c-command from an A-position is a necessary condition for syntactic scope licensing, a quantifier may in addition be licensed to take scope over a pronoun through properties of semantics. The transitivity effect in section 2.1 may be one example: if some other quantifier R is licensed to take scope over a pronoun P, and Q may take scope over R, then Q may take

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[20] See Hornstein 1995 for an interesting suggestion in this regard.

scope over P, so that variable binding and other scope-dependent relations between Q and P are allowed. In some cases (section 2.5) the effect is compounded: if R takes scope over P, and Q is exceptionally licensed (through properties of semantics) to take scope over R, then Q may take scope over P, hence variable-bind it.

I have also argued that these predictions cannot be made to follow from various alternative analyses. In section 1 I made a distinction between two types of conditions on bound variables: configurational principles and licensing principles. The examples discussed in the present section show that the relevant condition (of whatever type) must be based not on binding theory, but on scope theory. The transitivity examples show the effects of the A-c-command condition on the scope relation between pronoun P and the ''mediating'' quantifier R, although there is no binding-theoretic or coindexing relation between P and R. Similarly, donkey anaphora shows effects of the A-c-command condition between a quantifier and a pronoun it must take scope over (under any analysis, as an E-type pronoun or as a bound variable), although again there is no binding-theoretic relation between the quantifier and the pronoun. Similarly with non-NP scope dependencies subject to A-c-command, and with pronouns of laziness. These classes of examples all argue against both types of binding-based bound variable conditions: licensing principles based on coindexing cannot rule in the well-formed cases, and configurational principles cannot rule out the ill-formed ones. Furthermore, licensing principles based on binding cannot allow for the possibility of bound variable interpretations in the exceptional scope assignment examples of section 2.5.[21]

Of course, a relation of syntactic coindexing might simply be postulated for all pairs of expressions subject to WCO examined here. But there would be no syntactic evidence for this coindexing relation (from binding conditions or other principles) except for the WCO effect it would be used to describe. Nor would there be a semantic interpretation for this hypothetical coindexing relation (such as coreference or variable binding); it would thus remain completely stipulative.[22]

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[21] Space limitations prevent me from separately discussing all, or even most, representatives of the binding-theoretic or coindexing approach to WCO. To mention just a few, though: the strictly binding-theoretic view of Reinhart (1983) (basically condition (3a)) predicts none of the examples discussed in this section; its ''configurational'' counterpart, the Bijection Principle (Koopman and Sportiche 1982) fails on all but the ''exceptional licensing'' examples in section 2.5. By extending the notion of coindexing or replacing it with a derived notion, various authors have succeeded in describing some of the other facts discussed here. Thus, Haïk's (1984) indirect binding correctly predicts the donkey anaphora facts (except those involving transitivity) in section 2.2; Safir's (1984) Parallelism Constraint on Operator Binding, coupled with an index-copying mechanism, describes the transitivity effect (section 2.1); a similar index-copying mechanism accounts for the donkey anaphora facts of section 2.2 in Reinhart 1987. Higginbotham's (1980, 1983) Accessibility Condition (see also Huang 1995, Hornstein 1995), which employs mechanisms further removed from strict coindexing than the other proposals, captures both the transitivity effect and the donkey anaphora facts in section 2.2. It is important to note that attempted explanations of WCO in terms of movement theory (such as those mentioned in footnote 1) also cannot cope with any WCO examples where the pronoun and the relevant quantifier are not coindexed.

[22] To be more precise (if not pedantic), I see one possible semantic interpretation for this hypothetical coindexing relation: it might be taken to encode the relation of relative scope (or ''interpretive dependence,'' or some such notion), thus implementing the scope-theoretic approach defended here (see also footnote 23).

My conclusions here are empirical in nature, but they are not restricted to proposing a particular grammatical mechanism. I am not primarily interested here in defending the scope-theoretic hypothesis as it is expressed by condition (4). Rather, I have attempted to establish the more general point that, whatever the ultimate condition responsible for WCO turns out to be, it must belong to the theory of scope. WCO can be explained with a proper formulation of the conditions that allow a quantifier to take scope over a pronoun.

3 WCO in the Minimalist Framework

So far both theoretical and empirical progress have been made. I have argued first of all that, even from a relatively pretheoretical stance, considerable insight can be gained simply by viewing the conditions on bound variable licensing as belonging to scope theory. But I have also shown that a relatively minor adjustment of the Scope Principle (clause (4b)) actually derives many of the examples under discussion. In short, a reinterpretation of WCO as a scope phenomenon holds the promise of not just describing but explaining various exceptional cases of crossover.

But in order to be empirically adequate, I have resorted to a concomitant complication in scope theory, to wit clause (4b). The scope principle (4) raises several major questions, such as: can we give a principled account of the class of syntactic categories subject to clause (4b); and what other indications are there that the semantic interface level LF is interpreted by means of a scope principle of this type? In addition, various technical issues of implementation arise. These questions are addressed at length, and a more precise implementation is provided, in Ruys 1992.[23] Here, I want to explore a different route.

A major potential advantage of the scope-theoretic perspective on WCO (although one that was not taken advantage of in Ruys 1992; see footnote 23) is that it does not rely on a syntactic

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[23] In Ruys 1992 I propose an implementation that uses a diacritic scope-marking mechanism, which deals with scope reconstruction and specificity as well. These are the main rules:

  (i) *Scope Marking*
     a. Assign to α the index of any c-commanding category β as a superscript, at any level of representation (obligatory if α the trace of β); except
     b. Pronouns may be scope-marked only by XP in A-position.

A further constraint, which we need not go into, implies that weak NPs, unlike strong QNPs, may remain unmarked by c-commanding operators. LF representations enriched with scope-marking superscripts are interpreted by the following rules of interpretation:

  (ii) *Scope Principle*
     A is in the scope of B iff
     a. A is superscripted by B; or
     b. A is superscripted by C, and C is in the scope of B (transitivity).

  (iii) *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.

The Scope Principle (ii) is superficially similar to that proposed in Hark 1984; see Ruys 1992 for a discussion of crucial differences between the two proposals. To mention just one, it is essential to Hark's account that her scope-marking slash indices count as *referential* indices, as she intends to unify scope theory and binding theory. It should be clear from the foregoing discussion that nothing could be more distinct from my views. See also footnote 21.

relation of coindexing. I have shown above that this is empirically well motivated. Within the Minimalist Program (Chomsky 1995), it is also conceptually preferred. None of the other WCO hypotheses discussed above will fit into the minimalist framework, as they refer to a syntactically annotated relation between subexpressions that is neither maximally local nor conceptually unavoidable. This holds good to an even greater extent with regard to those extensions of the ''coindexing'' relation (slash indexing, etc.) that do not denote coreference or covaluation and are mere technical devices intended to capture exceptional cases of WCO. Within the Minimalist Program one wants to diagnose WCO as reflecting the mode of operation of the C-I (conceptual-intentional) interface component, in terms of a minimal set of notions that must be assumed to be operative at that level: say, c-command, covaluation/coreference, and relative scope. There are good indications that scope theory as it is developing in the Minimalist Program will yield the scope relations between operators and pronouns that I have claimed are revealed by the WCO phenomenon.

In this section I will sketch the outlines of a minimalist view of WCO that, although making use of the findings of previous sections, further reduces the stipulations required in order to derive the conditions on variable binding, specifically (4b). Although at present I cannot account for all the observations discussed in previous sections, I hope to be able to show that further research along these lines may prove fruitful.

Consider again a simple example of WCO in (42).

(42) ??Which boy$_i$ does his$_i$ mother like t$_i$?

In (42) the *wh*-operator has undeniably moved to a position where it c-commands the pronoun. Hence, one should expect there to be no difficulty in assigning it scope over the pronoun. Furthermore, the question operator in (42) is certainly interpreted with scope over the whole clause. Why, then, should the intended bound variable reading be unavailable if, as I claim, all that is required for such a reading is that the binding operator have scope over the pronoun? The answer comes from distinguishing the scope of the question operator from the scope of the *wh*-NP. As is well known, the observable position of an operator expression does not determine its scope. And the fact that the scope of the question operator in (42) is the whole clause does not necessarily imply that the scope of the *wh*-word is the same.[24]

Recent developments in the interpretation of *wh*-elements may allow us to see why the scope of a *wh*-NP is not identical to the scope of the question operator. Proceeding on the minimalist assumption that *wh*-in-situ do not move at LF but remain in situ (Chomsky 1993), Reinhart (1992, 1998) considers how *wh*-in-situ are interpreted. She observes that in examples like (43a) existing analyses lead to incorrect predictions. The assumption that *philosopher* remains in situ and is

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[24] In fact, Hark (1984) cites evidence that the scope of a *wh*-NP *cannot* be equated with the scope of the question operator.

(i) Which men did someone say that Mary likes t?

According to Hark, *someone* in (i) is not interpreted in the scope of plural *which men,* although it is in the scope of the question operator.

predicated over an individual variable bound by an operator in the position of *who* (through unselective binding, absorption (Higginbotham and May 1981), or movement of just *which* (Chomsky 1993)) implies that (43a) is interpreted as 'for which x and y is it the case that x will be offended if y is a philosopher, and we invite y'.

(43) a. Who will be offended if we invite which philosopher?
    b. $\{P \mid \exists\langle x,y\rangle \; [P = {}^{\wedge}((y$ is a philosopher $\wedge$ we invite $y) \rightarrow (x$ will be offended$)) \wedge {}^{\vee}P]\}$

(43b) is the interpretation that results if we adopt Karttunen's (1977) view that a question denotes the set of its true answers. The set (43b) will for example contain the proposition that Lucy will be offended if we invite Donald Duck (as Donald Duck is not a philosopher, the antecedent of the implication will be false; hence, P will be true). The incorrect prediction then follows that *Lucy will be offended if we invite Donald Duck* is a true answer to (43a).

In order to remedy the situation, Reinhart proposes that *wh*-in-situ are interpreted as follows. What is unselectively bound by the question operator is a variable that ranges over choice functions (which assign to each set in their domain a member of the set); this function is applied to the in-situ restriction on the *wh*-in-situ. This gives for (43a) the interpretation (44), which is correct.

(44) $\{P \mid \exists\langle x,f_{CF}\rangle \; [P = {}^{\wedge}($we invite $f($philosopher$) \rightarrow x$ will be offended$) \wedge {}^{\vee}P]\}$

(43a) now roughly paraphrases as 'for which x and which choice function f is it the case that x will be offended if we invite the individual that f selects from the set of philosophers'. The proposition that Lucy will be offended if we invite Donald Duck is not a member of the set of true answers (44), since there can be no f that selects Donald Duck from the set of philosophers.[25]

The result of Reinhart's proposal is that *wh*-operators may be interpreted in two distinct manners. In case they happen to move (overtly), they are interpreted through existential quantification over individual variables; in case they do not move, they are interpreted through existential quantification over choice functions. But in fact we only have semantic evidence that the latter option is required. Let us therefore suppose, in order to arrive at a uniform interpretation of *wh*-operators, that all *wh*-elements, including those that are preposed in syntax, must be interpreted through quantification over choice functions. This implies that *wh*-NPs must always undergo reconstruction at some level, since the result of applying a choice function to a set is an individual, not an operator, hence cannot be interpreted in operator position.[26]

It follows that the LF representation for (42) is in relevant respects as given in (45a), which in turn is interpreted as in (45b).

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[25] For elaboration and refinement of the choice function approach, see Reinhart 1997, Winter 1997, 1998.

[26] This account suggests of course that the preference principle proposed by Chomsky (1993) that says that reconstruction of preposed *wh*-elements must be maximal is a reflection of the need to massively reconstruct *wh*-operators for interpretive purposes. The fact that anaphors contained in *wh*-phrases may escape the reconstruction process may be due to an operation that extracts them from the *wh*-phrase prior to reconstruction. However, this leaves the effects of idiomatic readings on the *wh*-phrase unaccounted for.

(45) a. ??which$_j$ does his$_i$ mother like [t$_j$ boy]$_i$

    b. {P | ∃f_{CF} [P = ^(his$_i$ mother likes f(boy)$_i$) ∧ ^vP]}

Deriving (45a) is enough in itself to explain the WCO effect if we assume that a pronoun may not be coindexed with a non-DP: *which* may not bind *his,* and the intended reading is ruled out. We can even do without this condition on coindexing if we accept the choice function analysis (45b). In (45b) the existential quantifier takes scope over the complete sentence, including the pronoun. However, it cannot bind the pronoun as a variable, if we assume that pronouns can only be interpreted as variables ranging over individuals, not as choice function variables.

    Either way, we still correctly predict that variable binding is possible in (46).

(46) a. [$_{CP}$ Which boy$_i$ [$_{IP}$ t$_i$ likes his$_i$ mother]]?

    b. [$_{CP}$ which$_j$ [$_{IP}$ [t$_j$ boy]$_i$ likes his$_i$ mother]]

    c. {P | ∃f_{CF} [P = ^(f(boy) λx(x likes x's mother)) ∧ ^vP]}

In the LF representation (46b) the pronoun is bound by the in-situ remnant of the *wh*-DP. The interpretive process is illustrated in (46c). According to the usual analysis (Lasnik 1976, Reinhart 1983), the VP is interpreted as a λ-expression operating on the subject: the λ-operator has scope over, hence can bind, the pronoun.

    Can we extend this reasoning to apply to quantificational NPs? Consider (47).

(47) ??His$_i$ mother likes every boy$_i$.

In some ways, this is a weaker type of example. A puzzle arises only if we assume that the object *every boy* is capable of taking scope over the subject by QR: the question then is why it cannot bind the pronoun, and a WCO explanation is required. That the object can take scope over the subject is assumed on the basis of the ambiguity of such examples as (48).

(48) Someone loves everyone.

But it is well known that intuitions regarding the wide scope reading in (48) are far from secure. Native speakers unfamiliar with this field of linguistic research are notoriously reluctant to accept the wide scope reading for *everyone*.[27] Among linguists working in this field, intuitions have also been subject to debate and shifts in opinion. Even those who firmly believe that a wide scope reading is available will usually be more than ready to admit that the reading that reflects the surface order of the quantifiers is much more easily available than the inverted order.[28] In view

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[27] This is confirmed in experimental work; see for example Kurtzman and MacDonald 1993 and references cited there. Kurtzman and MacDonald report a strong preference for the observable order in [*a* N] V [*every* N] structures. Also, in [$_{NP}$ . . . NP] cases they found the inversely linked reading to be preferred, confirming the ''transitivity'' observation.

[28] The explanation for the difference in availability in performance between the two readings might run roughly as follows (as suggested in Ruys 1994a). The reason that QR is possible at all, given considerations of economy (as in Chomsky 1993), is that quantified expressions are not interpretable at LF unless occurring as the head of an operator-variable chain (see Epstein 1992). This overcomes Last Resort, but only allows a QNP to move to the nearest possible Ā-position, in view of Shortest Link. Therefore, the object in (48) should not be able to raise by QR to a position where it c-commands the subject at all. However, relativizing Shortest Link to interpretation (as in Golan 1993, Reinhart 1998, Fox 1995, Ruys 1994a,b), so that only derivations that result in equivalent interpretations are compared with respect to

of this, it is not clear that the difficulty in obtaining the bound variable reading in (47) differs significantly from the difficulty in obtaining the wide scope reading for the object in (48). In other words, the WCO effect detected in (47) may well reflect the general difficulty of assigning wide scope to the QNP in object position. If this is indeed the correct way of looking at these examples, the WCO phenomenon in (47) simply disappears.[29]

Nonetheless, a more positive approach is also available in the Minimalist Program. Chomsky (1993) argues that only the quantificational specifier *every* in *every boy* undergoes QR (Move Spec); a later version (Chomsky 1995:chap. 4) has it that only the formal features of the DP move (Move F). This leads to a reasoning similar to the one employed above with regard to *wh*-expressions. (47) is assigned the LF representation (49a).[30]

(49) a. every$_j$ [his$_i$ mother likes [t$_j$ boy]$_i$]
    b. every f_{CF} [his$_i$ mother likes f(boy)$_i$]

The DP *every boy* never takes scope over the pronoun; only the specifier *every* does. Again, we may rule out a bound reading for (49a) by assuming that a pronoun may only be bound by a DP. Or we can move one step further and derive this assumption from the way in which *every* is itself interpreted. In Ruys 1997 I suggest that the problematic semantics of quantificational specifiers that are separated through Move Spec from their restricting N′ may be resolved by assuming that, like *wh*-specifiers, they range over choice functions. If so, (49a) is interpreted as (49b), and we again derive the absence of a bound reading by assuming that pronouns never have a choice function–type reading. And again, a bound reading can only be obtained in (50a), as illustrated here.

(50) a. Every boy$_i$ likes his$_i$ mother.
    b. every$_j$ [$_{IP}$[$_{DP}$ t$_j$ boy]$_i$ likes his$_i$ mother]
    c. every f_{CF} [f(boy) λx(x likes x's mother)]

The Move Spec/choice function hypothesis exactly predicts the A/Ā bifurcation stipulated by many accounts of the crossover effect. It predicts that QR and *wh*-movement do not affect the variable-binding options of quantified and *wh*-expressions. Rather, these expressions behave as if they remain in an A-position, where they have the same binding options as any other term

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the length of their links, may overcome this in principle. Suppose now that, in performance, the effect of Shortest Link is that a QNP is assumed to move to the nearest possible Ā-position unless longer movement has been determined to result in a nonequivalent representation. This implies that the reading for (48) that results from the shortest possible movement will be easily detected, whereas obtaining the reading that requires a longer movement requires calculating interpretive equivalences, which entails a heavy processing burden.

[29] Intuitions with WCO are at least as volatile as intuitions on scope ambiguity. For example, *His mother gave every soldier a good luck charm to wear into battle* is much better than (47). WCO intuitions are much stricter with *wh*-antecedents, suggesting they may require a different explanation, as above. See Wasow 1979 for many examples of variation in acceptability with WCO.

[30] The analysis presented here is based on Ruys 1997, where I argue that Move Spec and Move F make the same predictions. Here I will concentrate on the Move Spec option: *every* moves, [t$_{every}$ boy] remains in situ. For a more detailed discussion, see Ruys 1997.

in an A-position. This in effect derives the conditions (3) and (4) for a promising range of cases. Furthermore, the choice function account attributes the WCO phenomenon to a semantic mismatch (pronouns function as individual variables at best, which cannot be bound by choice function quantifiers), so that WCO is seen to reflect a property of the C-I interface.

The conception described in this section requires significant further research. It has ramifications in such areas as *wh*-movement, reconstruction, and relative clause construction, which remain to be explored. Nevertheless, it should be appreciated that this project of further reducing the WCO effect to the conditions on scope assignment among operator-type expressions can only be undertaken now that it has been established, in the earlier sections of this article, that the conditions on variable binding are indeed to be explained as belonging to scope theory proper.

4 Conclusions

In this article I have attempted to establish the following point. The conditions under which an anaphoric expression may be interpreted as a bound variable must be explained by a principle belonging to scope theory, so that WCO must be considered a scope phenomenon. This conclusion was based on a range of facts that indicate, first, that the common denominator that unites various types of WCO violations cannot be expressed in terms of binding (or movement), but presumably is amenable to analysis in terms of relative scope (pronouns of laziness, non-NP dependencies, donkey anaphors); and second, that various semantic factors involved in the determination of scope relations may play a role in licensing bound anaphora (transitivity, exceptional scope). This leaves us with this desideratum for the optimal theory of bound variable anaphora: it must reduce conditions on bound anaphora to the conditions that license scope relations among linguistic expressions.

Besides formulating and defending this desideratum for a theory of bound anaphora, I have presented, partly for purposes of expository concreteness, a scope-licensing condition that allows the majority of data discussed here to be described, and partly explained.

The abundance of WCO analyses that have been proposed in the literature over the past 30 years suggests that these analyses may all be seriously underdetermined by the empirical data (which are often confusing and seldom allow definitive generalizations). In view of this record, it may well be the case that further progress in this area will not come from the study of these particular phenomena themselves, but must await developments in related areas to provide a theoretical framework for a more principled description of conditions on bound anaphora. Rather than wanting to add yet another, equally underdetermined WCO analysis to the growing catalogue, I have preferred therefore to examine some of the preconditions that must be met for a theory of bound anaphora to be successful, and to determine the area of linguistic research from which progress is most likely to be forthcoming. Perhaps, the program outlined in section 3 will prove fruitful in this sense.

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