Linear Order vs. Syntactic Rank: Evidence from Weak Crossover[1]

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Weak crossover has long been used as a diagnostic for syntactic phrase structure configurations (e.g. Reinhart 1983a,b, Farmer, Hale and Tsujimura 1986, Saito and Hoji 1983, Hoji 1985, Speas 1990, Mahajan 1990, among many others). Languages that have English-like weak crossover effects, such as Japanese according to Hoji 1985, are assumed to have an underlying configurational structure resembling that of English. Languages that do not have English-like weak crossover effects, such as Hungarian according to Kiss 1987 and Hindi according to Mahajan 1990, have been claimed either to have a non-configurational structure lacking a VP altogether or to have scrambling out of VP into A-positions, a mechanism which preserves configurational structure but effectively destroys the the unique configuration for subject-object asymmetries provided by the VP. The common assumption of such proposals is that the principles governing weak crossover reduce to c-command relations on syntactic phrase structure configurations.

It is my purpose to challenge this common assumption by showing that it is neither necessary nor sufficient to explain weak crossover effects. It is not necessary because all of the evidence for subject-object asymmetries in weak crossover can be explained in terms of the **syntactic rank** of pronoun and operator without any reference to c-command configurations. It is not sufficient because there is an orthogonal condition on the **linear order** of lexically represented constituents that constrains weak crossover independently of syntactic rank.

I will begin by explaining the theoretical assumptions behind my use of the concepts of syntactic rank and linear order. Then I will turn to evidence that supports the need for linear order and draw out some interesting implications for theories of scrambling, extractions, and null pronouns.

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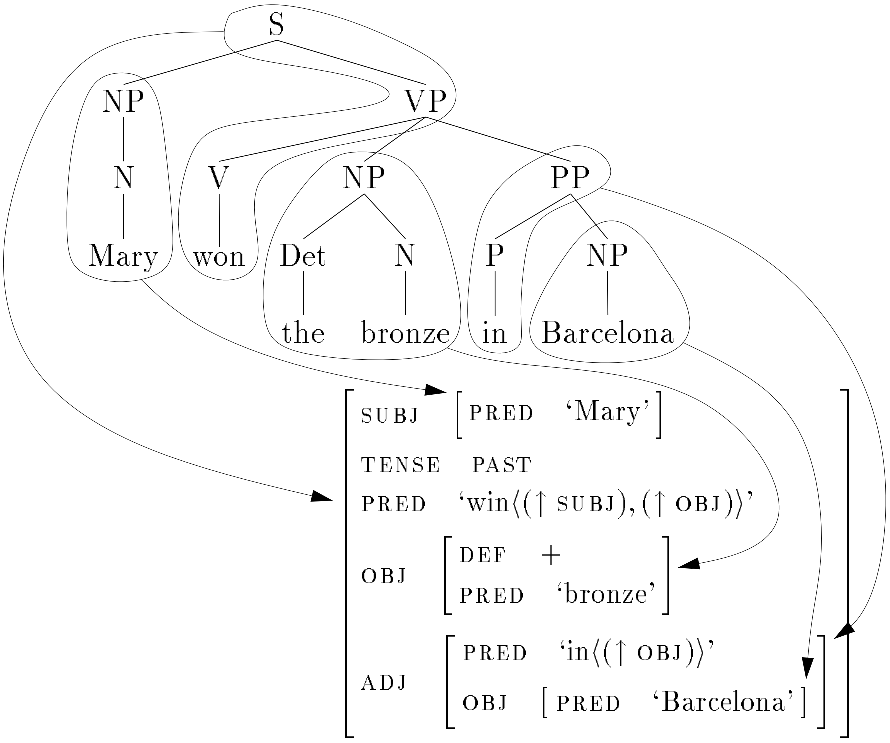
1 Theoretical Assumptions

1.1 Correspondences between Parallel Structures

Lexical-functional grammar (LFG) factors the syntactic representation of a sentence into parallel structures, including the c-structure and the f-structure, as illustrated in (1).[2] Each grammar defines a mapping μ from c-structure nodes to f-structures, illustrated by the connecting arrows in (1) (Kaplan and Bresnan 1982, Kaplan 1987):

(1) Mapping μ between c- and f-structure:



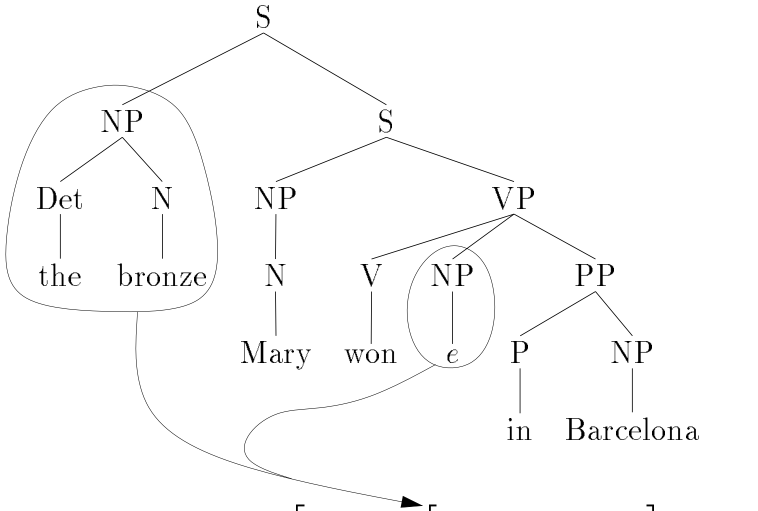
μ is mathematically a function, mapping each c-structure node onto a unique f-structure. Among its functional properties are first, that it is *many-to-one*, allowing different c-structure nodes to be mapped into the same f-structure. An example is the initial focused constituent and the gap node in (2). (In (1) and (2) nodes functionally connected by the "head of" relation are also mapped into the same f-structures, although this is not so in some recent work

[2]Formally related architectures include Kac 1978, Sadock 1991, Jackendoff 1994, and Andrews and Manning 1993, which connects some of these ideas to HPSG (Pollard and Sag 1994).

On the inclusion of a level of argument structure distinct from c- and f-structure, see Bresnan 1994 and the references cited there.

(Andrews and Manning 1993, Alsina 1993).)

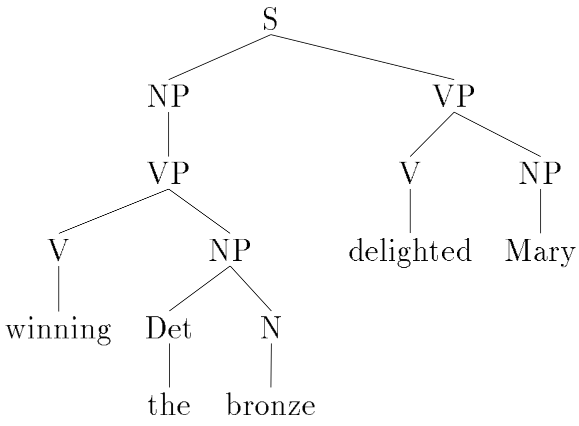
(2) Many-to-one:



$$\begin{bmatrix} \textsc{focus} & \begin{bmatrix}\textsc{def} & + \\ \textsc{pred} & \text{`bronze'}\end{bmatrix} \\ \textsc{obj} & \\ \textsc{subj} & \begin{bmatrix}\textsc{pred} & \text{`Mary'}\end{bmatrix} \\ \textsc{tense} & \textsc{past} \\ \textsc{pred} & \text{`win}\langle(\uparrow \textsc{subj}), (\uparrow \textsc{obj})\rangle\text{'} \\ \textsc{adj} & \begin{bmatrix}\textsc{pred} & \text{`in}\langle(\uparrow \textsc{obj})\rangle\text{'} \\ \textsc{obj} & \begin{bmatrix}\textsc{pred} & \text{`Barcelona'}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

Second, μ is *not onto*: there are f-structures which do not correspond to any c-structure node. An example is the null pronominal f-structure circled in (3).

(3) Not onto:



$$\left[\begin{array}{ll} \textsc{subj} & \left[\begin{array}{ll} \textsc{subj} & \left[\,\textsc{pred}\quad \text{`PRO'}\,\right] \\ \textsc{pred} & \text{`win}\langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\rangle\text{'} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{def} & + \\ \textsc{pred} & \text{`bronze'} \end{array}\right] \end{array}\right] \\ \textsc{tense} & \textsc{past} \\ \textsc{pred} & \text{`delight}\langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\rangle\text{'} \\ \textsc{obj} & \left[\,\textsc{pred}\quad \text{`Mary'}\,\right] \end{array}\right]$$

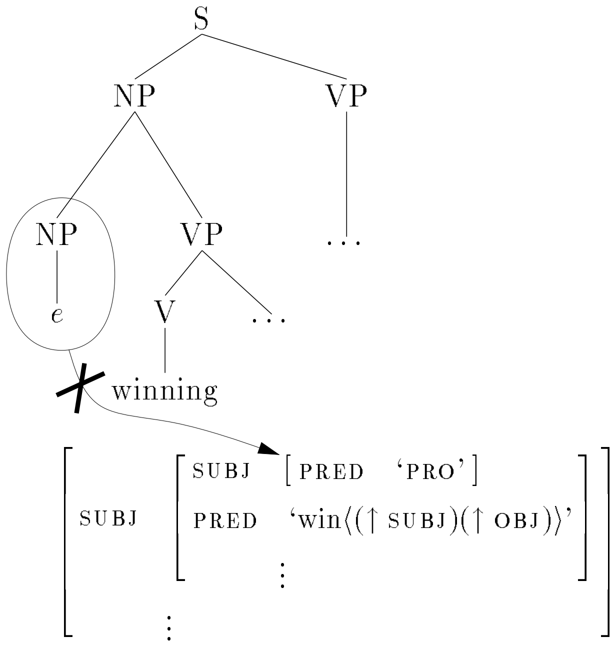
The null subject of the gerund is represented in the f-structure of (3), but not in the c-structure. This null pronominal is a functional property of nonfinite verbs in English. Because the verb is the head of its f-structure clause, it can specify properties of that f-structure, such as the presence of a null pronominal SUBJ (Bresnan 1982) and OBJ (Mohanan 1983, Simpson 1991, Hale 1983, Austin and Bresnan 1994). This manner of representation reflects a basic intuition underlying the design of the theory. F-structure represents the abstract function-argument organization of syntax. C-structure represents the surface order and constituency of forms of expression. According to this view, the proliferation of empty categories in phrase structure is an unnecessary projection of functional information onto the level of expression.

We can impose a condition on c-structure nodes to limit the use of empty categories. According to this condition, every c-structure node must be identified with a lexical element under the correspondence mapping μ:

(4) **Principle of Lexical Expression:**
The mapping μ from c-structure to f-structure must satisfy this condition: for every c-structure node N there is a lexical element w such that $\mu(N) = \mu(w)$.

(4) constrains the distribution of null c-structure categories: for every node N in c-structure, either (i) N dominates a lexical element with which it is identified through μ (namely, the head), or else (ii) N has the same image under the mapping μ as another node N' that satisfies condition (i). Suppose we had a null subject NP in c-structure as in (5):

(5)



Such a null NP is excluded by (3) because there is no lexical element w such that $\mu(w) = \mu([_{\mathrm{NP}}\ e\ ])$. In contrast, the empty category in (2) representing the gap is allowed because it is mapped by μ onto the same f-structure as the initial focused constituent.

1.2 Syntactic Rank on F-structure

Only at f-structure are all grammatical pronominals, including null pronominals, represented. In this framework, therefore, syntactic conditions on pronominal binding must be defined on f-structures, not c-structures. In place of the c-command relation which is assumed to constrain pronominal binding (Reinhart 1983a,b), there is a ranking of f-structure elements according to the functional hierarchy:[3]

[3]This formulation draws on unpublished proposals of K. P. Mohanan dating from 1980–1982 and J. Bresnan dated January 1987. Pollard and Sag's 1992 conception of 'o(bliqueness)-command' is essentially equivalent. All of these conceptions draw on the functional hierarchy of Keenan and Comrie 1977 and others. Reinhart (1983b: 101–6) proposes a similar formulation in terms of the relational hierarchy. Her arguments against such a formulation (pp. 103–6) either do not apply to the relational hierarchy given here (which

(6) **Syntactic Rank:**
For all f-structure elements A, B: A outranks B if A and B belong to the same f-structure and A is more prominent than B on the functional hierarchy (SUBJ > OBJ > OBL > COMPL > ...), or A outranks some C which contains B.

In terms of this ranking relation we can formulate an analogue of the well known 'noncoreference' condition, which applies to null and overt pronominals alike (Langacker 1969):

(7) **Syntactic rank and noncoreference:**
A pronominal P cannot outrank a constituent on which P is referentially dependent.

This condition can be illustrated by the following pattern of facts (Ross 1967):

(8) a. Mary_i's firing her_i friends

b.*her_i firing Mary_i's friends

In (a) and (b), the subject of the gerund is superior to the possessor of its object. Hence, the latter can be referentially dependent on the former (a), but the former cannot be dependent on the latter (b). In (9a) the overt pronominal object *her* controls the implicit subject of the gerund, and again the subject of the gerund—along with its controller—cannot be referentially dependent on the gerund object's possessor. In (9b) the controller is now *her mother*, so (7) no longer applies.

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includes predicate and sentential complements below argument other argument functions, and excludes adjuncts not included within arguments) or else fail to control for independent differences in stress prominence between subjects and objects. Thus, the apparent coreference asymmetry in (i) and (ii) disappears when the subject is destressed as in (iii) or the object is given focus stress as in (iv):

(i) *He_i was fired before John_i could get his pension.

(ii) They fired him_i before John_i could get his pension.

(iii) It would be WRONG for him_i to be fired before John_i could get his pension.

(iv) *HIM_i they fired before John_i could get his pension.

See Williams 1994 for further arguments against Reinhart's 1983b arguments for c-command.

Subtypes of objects and oblique functions can be distinguished and ranked according to their semantic case or thematic role (the O_θ and OBL_θ of Bresnan and Kanerva 1989, Bresnan and Zaenen 1990, and elsewhere). See Dalrymple (1993: 168–77) for one formalization. COMPL designates other complements, such as predicate complements and sentential complements (the XCOMPs and COMPs of Bresnan 1982).

(9) a.*Visiting Mary$_i$'s friends delighted her$_i$.

b. Visiting Mary$_i$'s friends delighted her$_i$ mother.

In English the rank of phrases on the functional hierarchy (SUBJ > OBJ > OBL > COMPL > ...) roughly corresponds to their depth of embedding in c-structure. Nevertheless, there are differences, which show that f-structure rank offers some advantages over c-command. For example, syntactic rank correctly captures the coreference patterns in examples (9a,b), because the sentential complement is lower on the functional hierarchy than the object NP in (a) and the oblique PP in (b):[4]

(10) a.*I convinced her$_i$ that Mary$_i$ should be my domestic partner.

b.*I proposed to her$_i$ that Mary$_i$ should be my domestic partner.

In (b) *her* fails to c-command *Mary*, but the noncoreference effect is the same as in (a). The preposition in (b) functions to mark an oblique complement of the verb, and in this case, the extra structural embedding created by the PP over the NP is irrelevant to the noncoreference condition, which looks only at the functional relation.

1.3 Linear Order on C-structure

While syntactic rank determines noncoreference relations in languages like English, linear order is clearly implicated in other languages. Mohanan (1983: 664–5) observes that in Malayalam, a Dravidian language of southern India, pronouns cannot precede their antecedents, but null pronominals are exempt from this restriction. Mohanan attributes this exemption to the absence of null pronominals from c-structure. The linear order condition is illustrated in (11a,b) from Mohanan. Example (11a) contains an overt pronoun which precedes the antecedent, and hence cannot be coreferential with it; in example (11b) the null pronoun replaces the overt pronoun, and coreference is possible.[5]

(11) a. [**awan** aanaye n̠uḷḷiyat̠inə s̄eesam] **kuṭṭi** uraŋŋi
he.N *elephant*.A *pinched*.it *after* *child*.N *slept*
'The child slept, after someone else/*the child pinched the elephant.'

b. [aanaye n̠uḷḷiyat̠inə s̄eesam] **kuṭṭi** uraŋŋi
elephant.A *pinched.it* *after* *child*.N *slept*
'The child slept, after the child/someone else pinched the elephant.'

[4]The problem posed by such examples is observed by Reinhart (1983b: 179) and Bach and Partee (1980: 13).

[5]The glosses of Mohanan (1981, 1983) are followed here; N, and A abbreviate 'nominative' and 'accusative' case, respectively.

If we reverse the order of the clause containing the pronominals and the antecedent, coreference becomes possible in both cases.[6]

Linear order is a relation on c-structure; hence, elements that are not represented in c-structure cannot enter into linear ordering relations.[7] Although f-structures are unordered, we can take into account some of the c-structure properties of pronominals, such as their linear order, through the correspondence mapping μ. μ induces an inverse image function μ^{-1} from f-structure to c-structure, defined by assigning to each f-structure the set of c-structure nodes mapped onto that f-structure by μ, and assigning the empty set $\emptyset$ to an f-structure element that has no corresponding c-structure node under μ. Referring to (2), one can see that the inverse image of the FOCUS f-structure consists of the two NP nodes dominating *the bronze* and the gap e; in (3), the inverse image of the circled f-structure is the empty set.

Using the inverse mapping μ^{-1}, we can define a relation of *f-precedence* as follows. An f-structure f_1 will f-precede another f-structure f_2 if all of the nodes in f_1's inverse image under μ precede some node in f_2's inverse image. In other words, all of the c-structures nodes that correspond to f_1 must precede at least some of the c-structure nodes that correspond to f_2.

(12) **F-precedence:**
f_1 f-precedes f_2 if and only if $\mu^{-1}(f_1)$ and $\mu^{-1}(f_2)$ are nonempty and all c_1 in $\mu^{-1}(f_1)$ precede some c_2 in $\mu^{-1}(f_2)$.

This formulation takes account of the fact that f-structures may correspond to sets of discontinuous or 'scattered' constituents in c-structure, because of the many-to-one property of μ. From this definition it follows that a scattered constituent cannot f-precede itself. If it did, all of its nodes would precede at least one of its nodes, but that one node could not precede itself. It also follows that a scattered constituent f-precedes another constituent when all of its scattered parts precede the other (13), but a constituent f-precedes a scattered constituent when (all of) it precedes any scattered part (14). $\mathcal{A}_1$ and $\mathcal{A}_2$ represent a scattered constituent $\mathcal{A}$ in (13) and (14).

(13) $\ldots\ \mathcal{A}_1 \ldots\ \mathcal{A}_2 \ldots\ \mathcal{C}\ \ldots$ [$\mathcal{A}$ f-precedes $\mathcal{C}$]

(14) $\ldots\ \mathcal{A}_1 \ldots\ \mathcal{C}\ \ldots\ \mathcal{A}_2 \ldots$ [$\mathcal{C}$ f-precedes $\mathcal{A}$]

Hence, of two scattered constituents which are interleaved, only one can f-precede the other—the one whose rightmost part precedes the rightmost part of the other, as in (15):

[6] These particular examples resemble English participle constructions, which exhibit subject control. However, as Mohanan 1983 shows, null pronominals in Malayalam differ from English controlled 'PRO' constructions in that they can occur in all of the nonoblique functions (subject, object, secondary object) and they can occur with tensed verb forms.

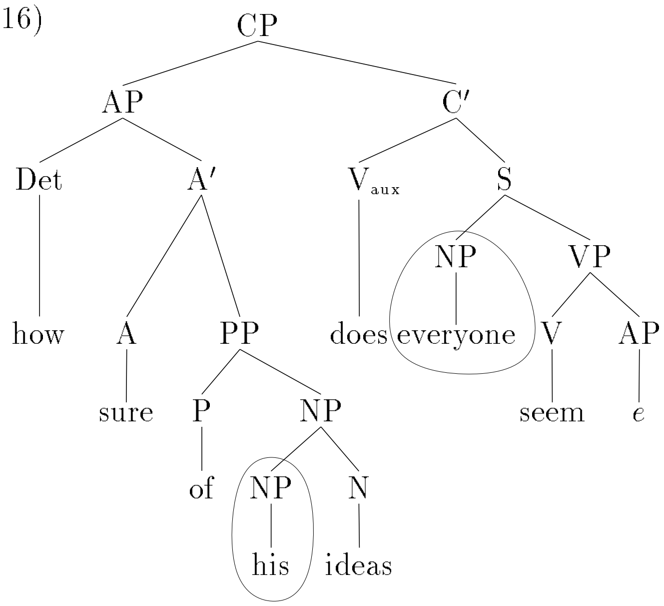
[7] A similar proposal is made in Kameyama 1985, following Bresnan 1984.

(15) … $\mathcal{A}_1\ \mathcal{B}_1 \ldots \mathcal{A}_2\ \mathcal{B}_2 \ldots$ [$\mathcal{A}$ f-precedes $\mathcal{B}$; $\mathcal{B}$ does not f-precede $\mathcal{A}$]

How does f-precedence compare to c-structure precedence? Both c-structure precedence and f-precedence are ordering relations, but f-precedence is not equivalent to c-structure precedence, because of the mismatches between f-structure and c-structure. For example, it is possible that c_1 precedes c_2 but $\mu(c_1)$ does not f-precede $\mu(c_2)$. Consider (2). In that example *the bronze* precedes *Mary* in c-structure, but μ(*the bronze*) does not f-precede μ(*Mary*) in f-structure. The reason is that *the bronze* and its gap are both mapped onto the same f-structure, and the gap fails to precede *Mary*, which would be required for f-precedence to hold (cf. (13) and (14)). However, μ(*the bronze*) does f-precede the ADJ(unct) *in Barcelona*.

It is also possible that f_1 f-precedes f_2, while c_1 in $\mu^{-1}(f_1)$ does not precede c_2 in $\mu^{-1}(f_2)$. Consider (16):

(16)



Here μ(*his*) f-precedes $\mu(e) = \mu$(*how sure of his ideas*) because *his* precedes the gap e, but *his* does not precede the AP *how sure of his ideas* because the latter dominates it.

We can now formulate the condition on Malayalam noncoreference given by Mohanan (1983: 664) in terms of the relation of f-precedence:

(17) **Linear order and noncoreference:**
A pronominal P cannot f-precede a constituent on which P is referentially dependent.

Essentially, f-precedence allows f-structure elements to inherit a linear order relation from the c-structure elements they correspond to under the mapping

μ. In the case of pronominals, f-precedence will distinguish those which are represented by a lexical element in c-structure from those which are not. Only the former will bear precedence relations to other constituents. Thus the null pronominal in (11) does not f-precede $\mu(kuṭṭi)$, the f-structure corresponding to the antecedent 'the child', because the inverse image of the null pronominal under μ is empty and the condition for f-precedence is not met. In other words, a null pronoun in f-structure has no linear ordering relations in c-structure to inherit.

1.4 Weak Crossover

Both syntactic rank and linear order potentially restrict the binding of pronominals by operators, producing so-called 'weak crossover' effects. We can formulate these conditions as in (18) and (19):

(18) **Syntactic rank and operator binding:**
The pronominal binding domain of an operator O is restricted to the set of f-structure elements that O outranks.

(19) **Linear order and operator binding:**
The pronominal binding domain of an operator O excludes all f-structure elements that f-precede O.

Let us take the term 'operator' for the moment to include quantifier phrases such as *everyone*, *no woman*, and *wh*-interrogative phrases such as *who*, *which suspect*. What counts as an operator is discussed in more detail subsequently (section 4.1).

Observe that the syntactic rank of the quantifier and pronoun differ in (20b) and (21b).

(20) a. His$_i$ mother visited John$_i$ on the night of the murder.

b.*His$_i$ mother visited everyone$_i$ on the night of the murder.

(21) a. John$_i$ was visited by his$_i$ mother on the night of the murder.

b. Everyone$_i$ was visited by his$_i$ mother on the night of the murder.

In the bad example of operator binding (20b), the quantifier is the object of a verb, while the pronoun is contained in the subject of the same verb; the object does not outrank the subject or the subject's constituents. In the good example of operator binding (21b), the operator is now the subject of the passivized verb, and the pronoun is contained in the prepositional object immediately following the verb; the subject outranks the prepositional object and its constituents.[8] The relative rank of the operator and pronoun correlates with their linear order: in the bad example, the pronoun f-precedes the operator; in the good example, it does not.

The domain conditions (18) and (19) also explain similar contrasts involving a *wh-* phrase operator extracted from the object or subject position, as in (22):

(22) a.?*Which suspect$_i$ did his$_i$ mother visit __ on the night of the murder?

b. Which suspect$_i$ __ was visited by his$_i$ mother on the night of the murder?

In (22a), just as in the preceding ungrammatical case, the operator does not outrank the pronoun that it binds, because *which suspect* is the object of *visit*, while *his* is contained in the subject. Although the fronted *wh-* word actually c-commands the pronoun, only the extraction site of the *wh-* phrase (__) counts for purposes of syntactic rank. This fact follows from our formulation in terms of the functional hierarchy in (6). Most accounts based on c-command stipulate that only 'argument positions' in phrase structure—that is, the clause-internal positions of subjects, objects, and other complements—count for calculations of relative syntactic rank for binding purposes; the nonargument ('$\overline{\mathrm{A}}$') positions of extracted constituents are excluded. In (22b), the operator is the subject and so outranks the pronominal contained in the prepositional object. In both (22a) and (22b) there is again a correlation between syntactic rank and linear order: the pronoun precedes the extraction gap in the (a) example, but not in the (b) example; hence the pronoun f-precedes the *wh-*phrase in the (a) example, but not in the (b) example.

Reinhart (1976, 1983a) argues that a syntactic rank condition is needed independently of linear order in cases such as (23):

(23) *Your eating everyone$_i$'s food annoyed him$_i$.

Here the pronoun is not in the domain of the operator and the variable binding interpretation, "For every person x, your eating x's food annoyed x" is not possible.[9]

[8]The insight that an operator can bind only those pronominals that it outranks is due in essence to Reinhart (1976, 1983a), who originally formulates it in terms of c-command. As we have already observed, c-command correlates fairly closely with syntactic rank in English.

[9]Note that coreference with a plural pronoun is possible, giving a group interpretation of *everyone* which, following Reinhart, we can assume is not an operator: *Your eating everyone$_i$'s food annoyed them$_i$.* See section 4.1 for analysis of violations of syntactic rank similar to (23) but acceptable.

In summary, in the predominantly right-branching syntax of English, the syntactic rank of the major clausal phrases corresponds not only to their depth of embedding, but also fairly closely to their linear order in the clause, a phrase on the left outranking a phrase to its right. Thus, the subject of a verb precedes the more deeply embedded object, and the object precedes the more deeply embedded prepositional object. Linear order relations are therefore roughly parallel to relations of syntactic rank. In each of the bad weak crossover cases discussed above, the pronoun in fact f-precedes the operator that binds it, but because the operator is also lower in rank than the pronoun, syntactic rank alone can explain the effect.

2 Linear Order vs. Syntactic Rank

A number of researchers have argued for an effect of linear order on weak crossover, including Mohanan 1981, Bresnan 1984, Haider 1989, Georgopoulos 1991a,b, and Williams 1994. In fact, early generative work recognized a leftness effect on pronoun antecedent relations (Langacker 1969) and the binding of pronouns by quantifiers and other operators (Postal 1972, Chomsky 1976). But following the lead of Reinhart (1976, 1983a,b), subsequent work has attempted to reduce all leftness effects to c-command and other order-free conditions on operator binding relations, such as biuniqueness (Koopman and Sportiche 1983) or parallelism (Safir 1984). More recently, the proposal that linear order affects the pronominal binding domain of operators in English has been revived from data on double objects by Barss and Lasnik 1986, only to be demolished by Larson's 1988 reanalysis of the verb phrase, which is expressly designed to build up a direct correspondence between the linear order of objects in the VP and their depth of embedding. The idea that scrambling can consist of movement to an A-position (Mahajan 1990) further reduces many leftness effects on pronominal binding found in scrambling languages to c-command. Such work has led to what is now the consensus view among many theorists that precedence plays no role in binding theory or conditions on operator binding. Indeed, in very recent work by Kayne 1993 it is proposed that precedence relations between constituents are simply a homomorphic projection of their asymmetric c-command relations.

Despite the difficulties of disentangling precedence effects from those of rank in English and typologically similar languages, there is evidence that the linear order of constituents can independently influence binding. In what follows, I will first show that a leftness effect on operator binding of pronominals is present even in English, although it is largely masked by the coincidence of syntactic rank, linear order, and depth of embedding in the overall syntax of the language. Next, I will consider weak crossover in Palauan, a Western Austronesian language spoken in the Western Carolines of the Pacific (Georgopoulos 1991a,b). In this VOS language the linear order of object and subject are opposite to their syntactic rank. Finally, I will consider weak crossover in Malayalam, which allows extensive free order or scrambling (Mohanan 1981, 1983). In the Malayalam data I present, linear order and NOT syntactic rank determines the pronominal binding domain of operators.

2.1 English

There are several sources of evidence for linear order effects on weak crossover in English. First, oblique arguments can often be fairly freely reordered, and in such cases we find a contrast in possible binding, as in (24a,b):

(24) a.?*As academic advisor to the women's college, it was my responsibility to talk about about her$_i$ coursework with every student$_i$.

b. As academic advisor to the women's college, it was my responsibility to talk with every student$_i$ about her$_i$ coursework.

Second, in (25a) pronominal binding by an operator is excluded from the PP into the AP. Yet the noncoreference effect in (25b) shows that the the PP complement to *seems* outranks the predicate complement AP. In (25c) the linear order of PP and the predicate complement is reversed, eliminating the weak crossover effect:

(25) a.*Clinton seems proud of her$_i$ to every woman appointee$_i$.

b.*Clinton seems proud of Mary$_i$ to her$_i$.

c. Clinton seems to every woman appointee$_i$ to be proud of her$_i$.

Third, some verbs allow reordering of their PP and CP complements. Again, a precedence effect is observable, as in (26):

(26) a.?*They explained how he$_i$ should dress to every male applicant$_i$.

b. They explained to every male applicant$_i$ how he$_i$ should dress.

Fourth, fronting of an AP complement containing a bound pronominal to a position preceding the operator destroys the binding relation:

(27) a. How sure of his$_i$ ideas does John$_i$ seem?

b.*How sure of his$_i$ ideas does everyone$_i$ seem?

(Cf. How sure does everyone seem?)

Observe that the subject in (27a,b) outranks the AP complement and its constituents, including the pronominal *his*, just as in the unmoved versions:[10] This is shown in (28):

(28) a. John$_i$ seems sure of his$_i$ ideas.

b. Everyone$_i$ seems sure of his$_i$ ideas.

Thus it must be the linear order of the pronoun and quantifier and not their f-structure relations that are affecting the pronominal binding.

These facts of English suggest that there is indeed a leftness effect on operator binding independent of syntactic rank, though it is largely masked by the coincidence of order and syntactic rank in the overall syntax of the language. English has both the linear order and syntactic rank conditions on pronominal binding by operators, given in (18) and (19).

2.2 Palauan

In languages in which left-to-right linear order does not correspond to descending syntactic rank, linear order effects can be seen clearly. In a VOS language, for example, the subject outranks the object, but the object precedes the subject, reversing the linear order we find in English. All things being equal, if rank alone determines the domain of operators, we would expect exactly the same pronominal binding effects that we have in English. If linear order restricts the domain, however, then the binding effects should diverge. Palauan, a Western Austronesian language of Micronesia with VOS order, provides an excellent test case, because its pronominal binding properties have been thoroughly studied by Georgopoulos (1991a,b).

Georgopoulos (1991a: 210–11) observes that weak crossover phenomena in Palauan exhibit "exhibited practically the mirror-image of what is predicted of these constructions" under various order-free formulations of the constraints on operator binding. That c-command alone (or syntactic rank in our terms) is not sufficient is shown by examples like (29). Here the quantifier subject outranks the pronominal contained in the object, but the VOS order means that the pronominal f-precedes the quantifier:[11]

[10]In fact, because the f-structures of extracted constituents are shared by two functions (the FOC or TOP function of the displaced constituent and the within-clause function of the gap), the f-structures of (27a,b) are actually substructures of those of (28a,b).

[11]The possessive pronominal represented by the possessive inflection on the head noun is glossed as *pro* by Georgopoulos. Georgopoulos' glossing abbreviations used here include L for 'linker', P for 'preposition', R for 'realis mood', and 3p for 'third person'.

(29) *toltoir er [a rederir] a **rebek el 'ad**
R.3p.*love* P *mother*.3p *every* L *person*
'Everyone$_i$ loves their$_i$ mother.'
(Georgopoulos 1991a: ex. (57c), p. 211)

That linear order alone is not sufficient for binding is shown by examples like (30). Here the quantifier object f-precedes but does not outrank the pronominal contained in the subject:

(30) *toltoir er a **rebek el 'ad** [a rederir]
R.3p.*love* P *every* L *person* *mother*.3p
'Their$_i$ mother loves everyone$_i$.'
(Georgopoulos 1991a: ex. (56c), p. 211)

Thus, Georgopoulos (1991a: 211) suggests that Palauan requires both c-command and linear precedence of the binder at s-structure. This corresponds exactly to our generalization about weak crossover in English given above. English and Palauan have the same linear order and syntactic rank conditions on operator binding given in (18) and (19).

There is one respect in which Palauan weak crossover effects seem NOT to match those of English. When the subject of the preceding Palauan example is topicalized or questioned, the result has "unblemished grammaticality" (Georgopoulos 1991a: 212):

(31) a **rebek el 'ad**$_i$ a oltoir er [a rederir] __$_i$
every L *person* R.*love* P *mother*.3p
'Everyone$_i$ loves their$_i$ mother.'
(Georgopoulos 1991a: ex. (58c), p. 212)

English operator extractions, in contrast, preserve the binding violations:

(32) a.*His$_i$ mother loves everyone$_i$ in that room.

b.*Everyone$_i$ in that room, his$_i$ mother loves.

However, there is a straightforward explanation for this difference between the two languages. Georgopoulos 1991a shows that unlike English, Palauan extractions always involve an *in situ* resumptive pronominal and are not subject to the 'island' or 'subjacency' constraints on extractions found in English. Weak crossover effects disappear when such a pronominal replaces the operator:

(33) Everyone$_i$ in that room is such that his$_i$ mother loves him$_i$.

In general, constructions in which resumptive pronouns are bound by operators lack weak crossover effects; this has been observed for Swedish and Hebrew (Sells 1984), Irish (McCloskey 1990), and Tuki (Biloa 1993), for example. In such cases there is no extraction and there is no gap; within the clause the resumptive pronoun occupies the argument position and bears the subject or object function. The clause-internal pronouns are anaphorically bound to the clause-external phrase by a separate mechanism that is not specific to operators (Bresnan and Mchombo 1987).

In sum, our comparison reveals common principles underlying the superficially differing weak crossover constraints on operator-pronominal binding in English and Palauan. In both languages, the domain of variable-binding operators is restricted by linear order AND syntactic rank (18) and (19). In the core cases of English, precedence coincides with syntactic rank. In the core cases of Palauan, precedence and syntactic rank are opposed.

2.3 Malayalam

Another language type in which linear order does not necessarily correspond to syntactic rank is a scrambling or so-called free word order language, such as the Dravidian language Malayalam of southern India. We have already seen an illustration of Mohanan's (1983: 664-5) observation that in Malayalam pronouns cannot precede their antecedents. In the following Malayalam examples, the antecedent is an operator, in this case a quantifier phrase (QP), and the same generalization holds.[12] Example (34) shows that a quantifier phrase (QP) subject may bind both null and overt pronominals embedded in a following object:

(34) in̲n̲ə **oor̄oo kuṭṭiyum** sahaayiccu
today each child.N *helped*
[in̲n̲ale (**awar̄e**) s̄akaar̄icca st̲riikaḷe]
yesterday (*they*.A) *scolded*.REL *woman*.A
'Today each child$_i$ helped the women who scolded them$_i$ yesterday.'

Example (35) differs only in the ordering of the main constituents of the sentence, the object containing the embedded pronouns now preceding the subject QP antecedent. A difference emerges in the binding possibilities of this example:

[12]These data on operator binding of pronominals in Malayalam were obtained by questionnaire from Tara Mohanan and K. P. Mohanan (personal communication, November 16, 1993). The glossing abbreviations are N, A, and REL for 'nominative', 'accusative', and 'relative'. The data given here reflect the judgments of K. P. Mohanan, except where otherwise noted.

(35) [in̲n̲ale (***awar̄e**) s̄akaar̄icca st̲riikaḷe]
yesterday (*they.*A) *scolded.*REL *woman.*A
in̲n̲ə **oor̄oo kuṭṭiyum** sahaayiccu
*today each child.*N *helped*
'Today each child$_i$ helped the women who scolded them$_i$ yesterday.'

Here the overt pronoun cannot precede its QP binder, and the null pronominal is exempt from this condition. (The overt pronoun is ungrammatical only for the interpretation indicated, in which it is bound by the operator. It may grammatically be used for other reference.)

An even more striking contrast emerges in the following examples (36) and (37), where the quantifier phrase is an object binding an overt or null pronominal embedded in the subject. The possibility of binding again depends on the relative linear order of pronominal and QP, exactly as in the preceding examples:

(36) **oor̄oo kuṭṭiyeeyum** in̲n̲ə sahaayiccu
*each child.*A *today helped*
[in̲n̲ale (**awar̄ə**) s̄akaar̄icca st̲rii]
yesterday (*they.*N) *scolded.*REL *woman.*N
'The woman who they$_i$ scolded yesterday helped each child$_i$ today.'

(37) [in̲n̲ale (***awar̄ə**) s̄akaar̄icca st̲rii]
yesterday (*they.*N) *scolded.*REL *woman.*N
in̲n̲ə **oor̄oo kuṭṭiyeeyum** sahaayiccu
*today each child.*A *helped*
'The woman who they$_i$ scolded yesterday helped each child$_i$ today.'

Observe that in these examples, the operator does not outrank the pronominal. Thus operator binding is constrained by linear order and NOT by syntactic rank, as originally observed by Mohanan (1981, 1983).[13] (Again, the overt pronoun is ungrammatical only for the interpretation indicated, in which it is bound by the operator. It may grammatically be used for other reference.)

One might suspect that these examples do not involve true operator binding: in view of the use of the plural forms of the pronoun *awar̄e* 'they' used

[13]Here the judgments of Tara Mohanan differ from those of K. P. Mohanan: she disallows example (36) with a null pronoun and finds example (37) questionable with a null pronoun. These judgments suggest the tentative generalization that in her speech the operator must either outrank or f-precede the pronominal. Tara Mohanan also differs from K. P. Mohanan in being a bilingual speaker of Hindi.

in these examples, the pattern might simply reflect ordinary coreference of a plural pronoun with a group-denoting phrase (cf. n. (9)). A referential NP of this type would be subject to the same noncoreference condition previously observed in (17) for nonoperator NPs, and that would explain the data without any implications for operator binding and weak crossover. However, Mohanan (1981: pp. 50e,f) shows that both interrogative and quantifier phrase operators in Malayalam differ in their binding conditions from simple referential NPs such as proper nouns: unlike simple NPs, the operators must f-command the pronoun they bind.[14] In other words, the minimal clause or predication structure that contains the operator must also contain the pronoun. This difference is illustrated in (38a–c):

(38) a. [meer̄i **jooṇine** umma weccu eṉṉə]
Mary.N *John*.A *kiss* *placed* *that*
awan paran̄n̄u.
he.N *said*
Lit.: 'He$_i$ said that Mary kissed John$_i$.'

b. *[meer̄i **aar̄e** umma weccu eṉṉə]
Mary.N *who*.A *kiss* *placed* *that*
awan paran̄n̄u.
he.N *said*
Lit.: 'Who$_i$ did he$_i$ say that Mary kissed?'

c. *[meer̄i **ellaawar̄eyum** umma weccu eṉṉə]
Mary.N *all*.A *kiss* *placed* *that*
awar paran̄n̄u.
they.N *said*
Lit.: 'They$_i$ said that Mary kissed everyone$_i$.'

Observe that in (38c) a plural pronoun is used with the quantifier, which is subject to the same f-command condition on operator binding as the other operators. We can therefore conclude that these Malayalam examples involve true operator binding.

How do we know that the left-to-right linear order of constituents in Malayalam does not necessarily correspond to their asymmetric c-command relations? After all, Mahajan's 1990 analysis of Hindi (an Indic language with many areal similarities to Dravidian) builds exactly this correspondence in to the theory of scrambling. For Mahajan (1990: p. 42), "clause internal leftward

[14]Mohanan 1981 refers to this relation as c-command, assuming a VP-less c-structure for Malayalam; f-command (Bresnan 1982) provides an equivalent constraint here, irrespective of the presence of a VP. However, the f-command formulation also encompasses null pronominals not represented in c-structure.

scrambling is to an A position"—such as the Specifier of a higher functional projection; clause external scrambling is leftward to an A′ position. Thus scrambling produces binary right-branching structures in which a phrase c-commands everything to its right and is c-commanded by everything to its left. Now weak crossover for Mahajan requires that "to be construed as a bound variable, a pronoun must be c-commanded by a binder and its variable (if there is one) at s-structure" (p. 23). The innovation of requiring the binder itself and not just its variable to c-command the bound pronoun means in the context of the scrambling theory that a binder must precede any pronoun it binds.

These assumptions can account for Malayalam examples like (34) and (36), where the binder is to the left of the bound pronoun. (Note in (36) in particular the assumption that the clause-initial position of the object is an A-position prevents its trace in the pre-scrambling position from counting as a variable and thereby triggering a weak crossover violation.) But they cannot explain the binding of the null pronouns in the phrases which preceded the binder in (35) and (37). Nor would it help to invoke reconstruction (the replacement of moved material back into its pre-movement position in Logical Form) to explain the binding of the null pronominals: in (37) the operator object never c-commands the null pronominal contained in the subject, even after reconstruction. Nor can these assumptions explain noncoreference effects in (11) with nonoperator antecedents.

In contrast, these binding differences between the null and overt pronouns follow from the linear order condition on c-structure (which is Mohanan's original insight formalized here in terms of f-precedence). Moreover, the f-precedence condition can account not only for the Malayalam generalizations but for Mahajan's Hindi data on weak crossover as well. We need only assume for Hindi, following Mohanan 1990, Butt 1993 for Urdu, and Mohanan 1982 for Malayalam, that the clause-internal ordering of nominal constituents is syntactically free, so that alternative orders are base-generated without extraction gaps. Mahajan's data on weak crossover in Hindi then follow from the same linear order condition given for Malayalam: a pronoun cannot f-precede its binder. Hence, linear order can provide a more general account of pronominal binding than c-command for some scrambling or free word order languages.[15]

In sum, these generalizations from Malayalam, Palauan, and English show us that quite independently of syntactic rank, linear order can restrict the pronominal binding domain of operators.

[15]This claim appears to be true as well for German (Haider 1989) and Hungarian (Kiss 1987).

3 Probing for Empty Categories

The existence of an irreducible linear order condition on binding has interesting consequences. Linear order can be used as a probe for empty categories: if empty categories exist in phrase structure, then they bear precedence relations for binding, as originally observed by Mohanan 1983 (also Bresnan 1984, Kameyama 1985). It turns out that some kinds of hypothesized empty categories do bear predecence relations, and some do not.

In Malayalam or Hindi, if the clause-internal scrambling of an operator over a pronoun left an extraction gap, the pronoun would f-precede the operator, causing a weak crossover violation as illustrated in (39):

(39) * $[\mathbf{Op}_i]_{\text{OBJ}} \ldots [\ldots \mathbf{pron}_i \ldots]_{\text{SUBJ}} \ldots [e_i] \ldots$

But this kind of violation does not occur in Malayalam according to Mohanan 1981 or Hindi according to Mahajan 1990. A Hindi example is shown in (40):[16]

(40) [**kis-ko**$_i$ **uskii**$_i$ bahin pyaar kartii thii?]
who-(DO) *his* *sister*.(SUB) *love* *do*.IMP.F *be*.PST.F
'Who$_i$ was loved by his$_i$ sister?' Lit.: *'Who$_i$ did his$_i$ sister love?'
(Mahajan 1990: p. 26)

We can infer that there is no gap in (40) and the clause internal order is simply syntactically free constituent order.[17] In contrast, extraction of the operator from a clause-internal to a clause-external position in Hindi does produce a weak crossover violation, as illustrated in (41):

(41) *[**kis-ko**$_i$ **uskii**$_i$ bahin-ne socaa [ki
who.(DO) *his* *sister*-(SUB) *thought* *that*
raam-ne $[e]_i$ dekhaa thaa]?]
Ram-(ESUB) *seen* *be*.PST
'Who$_i$ was it that his$_i$ sister thought that Ram had seen him$_i$?'
Lit.: *'Who$_i$ did his$_i$ sister think that Ram had seen? (Mahajan 1990: p. 39)

[16]Mahajan's 1990 glosses are used here. They include DO, SUB, EDO and ESUB for 'direct object', 'subject', 'embedded direct object' and 'embedded subject'; IMP, F, and PST stand for 'imperfect', 'feminine', and 'past'.

[17]Free order of this type could be represented either by a flat c-structure in which subject and object are unordered sister constituents, as in Mohanan 1982, T. Mohanan 1990, Simpson 1991, and Butt 1993a,b, or by a hierarchical c-structure in which subject and object can be generated *in situ* in TOPIC and FOCUS positions, as in King 1993. The latter analysis requires no extraction gaps as long as all arguments occur within the local region of c-structure projections that are co-mapped into the same f-structure (approximately corresponding to Grimshaw's 1991 'extended projection'). The choice among representations must depend upon constituency considerations instead of binding behavior.

In (41) the pronoun lies in the matrix clause, where it must precede any gap within the following embedded clause. If the pronoun instead occurred in the embedded clause, then by clause-internal free order, it could follow the gap and there should be no weak crossover violation. This prediction is true, as shown in (42):

(42) [**kis-ko**$_i$ raam-ne socaa [ki [e]$_i$
who.(EDO) *Ram.*(SUB) *thought that*
uskii$_i$ bahin-ne dekhaa thaa]?]
his sister.(SUB) *seen be.*PST
'Who$_i$ did Ram think was seen by his$_i$ sister?' Lit.: *'Who$_i$ did Ram think that his$_i$ sister had seen?' (Mahajan 1990: p. 42)

Thus we can infer that clause-internal reorderings in Hindi as in Malayalam are free constituent order (under one of the interpretations in footnote 17), while nonlocal reorderings involve extraction gaps.

We can also see that English interrogative and topicalization extractions also leave gaps, even when local to the clause:

(43) a.?*To whom$_i$ did Mary seem proud of him$_i$ __?

b.??Who(m) did they explain how he$_i$ should dress to __?

c.?*Everyone$_i$ in the room, I talked about his$_i$ coursework with __.

The problem in each of the examples can be attributed to the pronominal binding, as control examples in (44) indicate:

(44) a. To whom did Mary seem proud of herself __?

b. Who(m) did they explain how we should dress to __?

c. Everyone$_i$ in the room, I talked about coursework with __.

If we assume that the gaps in (43) are represented by empty categories in c-structure, then the failure of binding is explained. In (43a), for example, the pronoun then f-precedes *to whom*, because the gap following the pronoun is mapped by μ onto the same f-structure as the *wh-* phrase.[18] If there were no gap in this example, then the interrogative would f-precede the pronoun and the similarity to (25b) **Clinton seems proud of her$_i$ to every woman appointee$_i$* could not be captured. Syntactic rank cannot explain these examples, because as we observed above, the operator outranks the pronoun in each case.

The further contrast between (43b) and (45) also follows at once, because the controlled null subject of the infinitive in (45), lacking a c-structure category, does not precede the *wh-* gap, and so fails to f-precede the *wh-* operator:

[18]This example is an instance of (14), with the pronoun as $\mathcal{C}$ preceding the gap as $\mathcal{A}_2$.

(45) Who(m) did they explain how to dress to __?

Similarly, as we have seen, the null pronominals of Malayalam have no linear order effects on binding.

We see that extraction gaps crucially determine the precedence relations that restrict operator binding domains, while free ordering and null pronominals do not. These results are consistent with our hypothesis that only the former are represented in c-structure, by the Principle of Lexical Expression (4). Null pronominals are completely unexpressed in c-structure.

At first sight, the precedence effect in the Palauan example cited above (29) seems to show that null pronominals pattern with overt pronouns.[19] Here, however, the noun *rederir* 'mother.3p' is inflected for a third person possessor. When an overt NP possessor is not present, a third person pronominal possessor is implied by the possessive inflection. This inflection is thus analogous to the Chicheŵa verbal subject prefix, which is shown by Bresnan and Mchombo (1986, 1987) to be functionally ambiguous between a marker of grammatical agreement and a morphologically bound pronoun.[20] To speak of "null pro(noun)s" or "pro drop" in such cases is inaccurate because, as noted by Bresnan and Mchombo (1987: 765), the affix itself is the pronoun: the mapping μ from c-structure to f-structure associates an f-structure pronominal with the affix of the inflected verb or noun, as illustrated schematically in (46).[21]

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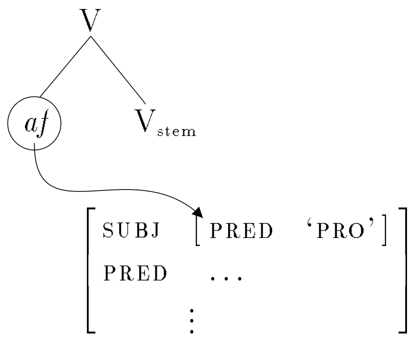
[19] Jaeggli and Safir (1989: p. 18) also note that Spanish null pronouns pattern like overt pronouns rather than PRO with respect to weak crossover.

[20] Georgopoulos (1991a: pp. 48-51) argues against the interpretation of the Palauan agreement inflections as bound pronouns, appealing to the noncomplementary distribution of the inflections and lexically filled NPs, whether as simple arguments or conjuncts, and their parallel role in binding phenomena. She then observes (p. 50), "As an alternative to the foregoing arguments for *pro*, we could assume that an NP node is present only when it contains lexical material, even though an argument selected by a head is not always lexical." (This is, in effect, the analysis advocated by Bresnan and Mchombo 1987.) After pointing out that on this alternative, transitivity could not be defined uniformly on the phrase structure representation (it is defined on the f-structure for Bresnan and Mchombo 1987), she concludes: "Such a consequence is not only incompatible with X′ theory, theta theory, and theories of the lexicon, but it requires parallel principles of structure where one (that the argument position is always present [in phrase structure—JWB]) will do. The alternative approach is therefore rejected." This reasoning, of course, begs the question: the arguments in favor of the theoretical architecture she assumes simply reduce to a restatement of the basic assumptions of that theoretical architecture. In fact, no duplication of principles of binding is required if they are defined over f-structures rather than c-structures.

[21] For more on the relation between inflections and f-structure, see Andrews 1990.

(46)



Pronominals expressed by such affixes therefore inherit linear order relations from the affix. Malayalam, in contrast, lacks agreement affixes. Hence, the null pronominals of Malayalam cannot cannot inherit linear order relations from their morphological expression.[22] The same is true of the null controlled pronominal in English.

The evidence from Malayalam thus supports the hypothesis that true null pronominals are exempt from the precedence restriction on binding domains, while extraction gaps are not. These results conflict both with the proposal that there are no empty categories (Kaplan and Zaenen 1988, Zaenen 1989, Pollard and Sag (1994: ch. 9)) and with the assumption that all lexical arguments are syntactically represented by phrase structure categories via the Projection Principle (Chomsky 1981). Instead, it appears that empty categories exist for extraction gaps, but not for null pronominals, and the principle which distinguishes the two types is something like the Principle of Lexical Expression (4). In other words, null elements can exhibit precedence effects only if they are represented by some lexical element (such as a displaced *wh*-constituent or an agreement inflection) in c-structure.

4 Other Factors

A number of known factors not specific to the proposal advanced here affect weak crossover.

4.1 Operator Complexes

The class of variable binding operators subject to the domain conditions discussed here is generally held to include not only QPs headed by *every*, *no*, and the like, but also interrogative phrases *who*, *what*, *which X whose X*, and

[22]The verb in Malayalam optionally specifies the pronominal content of its direct verbal arguments as properties of the f-structure of the entire clause headed by the verb.

focused or topicalized constituents.[23] It is necessary to extend this class to a larger set of constituents that I will call *operator complexes*.

A simple characterization of operator complex is that it is a phrase that "Pied Pipes" (Ross 1967) with an operator, as illustrated in the following example:

(47) $\underbrace{\overbrace{\text{Whose}}^{\text{Operator}}\text{ brother's friend}}_{\text{Operator complex}}$ did you visit?

What counts as an operator complex varies across languages and may be somewhat variable across speakers of the same langauge.[24] Common English operator complexes include phrases whose specifiers are (true) variable-binding quantifiers (e.g. *every woman*, *no man*, *which book*), possessors (e.g. *no man's children*, *whose sister's friend*), and prepositional phrases dominating operator-complex objects (e.g. *to every woman*, etc.). In the case of simple NP (or DPs) operators such as *who*, *whom*, *everyone*, *no one*, which are not dominated by Pied Piping material, we can take the phrase itself to be its own operator complex.

The crucial property of operator complexes is this: an operator O which by itself does not outrank a pronoun can bind that pronoun if O belongs to an operator complex that does outrank the pronoun.[25] This phenomenon is illustrated in (48) and (49), where the binder in the (a) examples does not outrank the pronoun it binds, but the complex it is contained in does.

(48) a. Everyone$_i$'s mother loves his$_i$ cute ways.

b. Everyone's mother$_j$ loves her$_j$ free time.

(49) a. Whose$_i$ mother loves his$_i$ cute ways?

b. Whose mother$_j$ loves her$_j$ free time?

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[23]Lasnik and Stowell 1991 argue that only true quantifiers should count as operators in this domain. See Postal 1993 for qualifications.

[24]In Malayalam (Mohanan 1981), in Chinese (Higginbotham 1980), and in Hungarian (Kiss 1987), it appears that an operator complex is limited to the operator phrase itself.

[25]I will not explore the semantic basis for this phenomenon here. It is possible that *every*, *which*, and the other variable-binding operators are 'unselective' quantifiers or polyadic operators over all of the predicates in the operator complex:

(i) every man's mother: $(\forall x, y)((x \text{ a man})(y \text{ the mother of } x) \rightarrow \ldots)$

The domain of an operator is thus defined by its operator complex, and its precedence restrictions are defined with respect to that complex as well:

(50) a.*Whose mother$_j$ is her$_j$ free time loved by?

b.*Whose$_i$ mother loves his$_i$ cute ways?

In (b), *his*$_i$ does not f-precede *whose*$_i$, but it does f-precede the operator complex of *whose*, by virtue of preceding the gap of *whose*$_i$ *mother*.

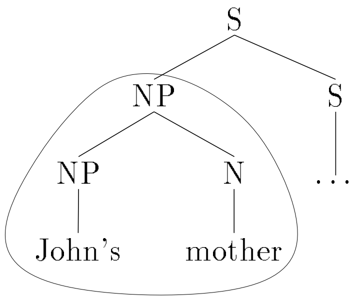
The conditions on pronominal binding can be generalized to operator complexes as follows:

(51) **Syntactic rank and operator binding (revised):**
The domain of O is restricted to the set of f-structures that O's operator complex outranks.

(52) **Linear order and operator binding (revised):**
The domain of a variable-binding operator O excludes all f-structure elements that f-precede O's operator complex.

Finally, note that if we define a topicalized constituent to be its own operator complex—

(53)



—we can explain contrasts such as the following observed by Wasow 1979 (see also Postal 1993):

(54) a. John$_i$'s mother, his$_i$ friends adore.

b.*Everyone$_i$'s mother, his$_i$ friends adore.

c.*Whose$_i$ mother do his$_i$ friends adore?

4.2 Control and Indirect Binding

There are cases in which a pronoun is interpreted as bound to an operator even though it it is not in the domain of the operator as defined in (51) and (52):[26]

(55) a.*His$_i$ losing his$_i$ marbles irked every boy$_i$.

b. Losing his$_i$ marbles irked every boy$_i$.

c.*Losing his$_i$ marbles irked every boy$_i$'s mother .

In (a), *every boy* does not outrank *his*, and binding is ill formed. The necessary syntactic rank relation is also lacking in (b), but binding is nevertheless possible, though it is ill formed again in (c). What is going on in (b) is anaphoric control (see the discussion of (9) above). Anaphoric control is not subject to c-command or rank, but to distinct functional and semantic factors, including the thematic role structure of the predicate (see Bresnan 1982, Mohanan 1983, Kroeger 1993, and the references cited in these). In (b) the object of the verb anaphorically controls the null subject of the gerund, and that subject binds the pronominal *his*. The operator thus binds the pronoun indirectly, through the control relation. In (c), there is no control relation between the operator and the pronoun, and binding is ill formed.

I believe that a similar phenomenon occurs in (56a), where the *of* phrase in this case is the semantic controller of the nominal subject: no matter how good a soldier you may be, someone else's devotion cannot be expected OF YOU. When this implicit control relation linking the operator to the nominal is absent, as in (56b) and (56c), the expected weak crossover violations appear.

(56) a. Devotion to his$_i$ country is expected of every soldier$_i$.

b.?*Devotion to his$_i$ country is expected of every soldier$_i$'s family.

c. *How devoted to his$_i$ country is every soldier$_i$?

Finally, (57a) illustrates the so-called 'functional' binding cases discussed by Engdahl 1986 and Chierchia 1991. These are good if we expect an answer such as *his first book*, which gives a general function from authors to books. It seems that in these cases, the pronoun is not directly bound by the operator but by the function which is the denotation of the NP containing it. Again the conditions on interpretation here differ from those on weak crossover considered earlier, as shown by (57b,c).

(57) a. Which of his$_i$ books does every author$_i$ like least?

[26]Examples like (55b) are observed in Higginbotham (1980: 688).

b.?*Which of his_i books do every $author_i$'s parents like least?

c. *How proud of his_i books does every $author_i$ seem?

A number of other factors affecting weak crossover have been discussed (see Postal 1993, Reinhart 1983b, and Williams 1994, among others). I will not attempt to give a comprehensive treatment of these factors because they do not distinguish my proposal from others.[27]

5 Conclusion

In conclusion, weak crossover should not be used as a diagnostic for phrase structure configurations, because the syntactic asymmetries it reveals can be explained by syntactic rank independently of c-command relations, and because independently of syntactic rank, it is subject to linear order effects. This conclusion has interesting consequences for theories of extraction, scrambling, and null pronominals, suggesting that not all null pronominals and not all 'movements' of phrase structure categories are represented by empty categories in phrase structure.

The fact that syntactic rank—a functional or relational property of syntax—can be independent of linear order—a structural, categorial property, is completely opposed to the reductionist trend of syntactic theory represented in work by Larson 1988, Mahajan 1990, and Kayne 1993, among others. But it is a rather natural result within an architecture of grammar based on parallel structures, each with its own formal elements and prominence relations, which simultaneously constrain the surface forms of language.

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[27] Both Reinhart 1983b and Williams 1994 discuss theta role structure as a factor in weak crossover. In the present framework the relative prominence of different role relations is represented in the a-structure and could be formalized as a constraint on that dimension (cf. Bresnan 1994, Dalrymple 1993, and the references cited in these sources).

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