CROSSOVER EFFECTS, CHAIN FORMATION, AND UNAMBIGUOUS BINDING*

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0. Introduction

In this paper, I pursue two goals. First, I will show that Rizzi's (1986) account of crossover effects in terms of a local binding constraint on chain formation is empirically too strong. On the basis of data mainly from German (but also from Italian and English), I argue that crossover effects occur in constructions involving *wh*-movement, topicalization, scrambling, and head movement, but, contrary to Rizzi's assumptions, do not show up with Case-driven movement, i.e. A-movement in passive and raising constructions, and dative movement in double object constructions (DOCs).

My second and more specific goal, then, is to develop a different approach to crossover effects. It turns out that Case-driven movement does not only fail to induce crossover effects; what is more, it does not give rise to improper movement either. In contrast, other movement types, which are not Case-driven, do both. This suggests that a unified approach should be developed which subsumes improper movement and crossover. In Müller & Sternefeld (1990), it is argued that various kinds of improper movement can be excluded by a condition which requires variables to be bound in an unambiguous manner, viz. the Principle of Unambiguous Binding (PUB). This principle was originally developed in order to account for asymmetries between various kinds of A-bar movement, by postulating a lack of interaction between, e.g., *wh*-movement, topicalization, and scrambling. I will show, however, that the PUB can be made to account for crossover effects in a fairly straightforward manner, too. Thus, since the PUB makes exactly the right predictions in a domain it was not originally developed for, it receives strong additional confirmation.

I will proceed as follows. In section 1, I review the classical strong crossover effect with *wh*-movement. In section 2, I turn to constructions involving A-movement and *si*-cliticization in Italian, and argue, on the

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basis of evidence from German, that it is clitic movement (i.e., head movement), rather than A-movement, which is responsible for crossover effects. In section 3, I discuss some aspects of DOCs in German and English. There are reasons to distinguish two VP-internal movement types, viz. scrambling (which is not Case-driven), and dative movement (which is Case-driven). It turns out that crossover effects in DOCs show up only with scrambling, and not with dative movement. After investigating the distribution of crossover effects among movement types, in section 4 I briefly recapitulate some of the evidence presented by Müller & Sternefeld (1990) in support of the PUB as a constraint against improper movement. In section 5, then, I show that the PUB accounts for the crossover facts discussed in the first three sections. Finally, in the appendix I address the status of intermediate traces w.r.t. crossover and improper movement.

1. Crossover and *Wh*-Movement

Postal (1971) and Wasow (1972) have pointed out that *wh*-movement across a co-indexed, c-commanding pronoun results in ungrammaticality. This phenomenon has become known as 'strong crossover:'

(1) a. *Who$_i$ does she$_i$ like t_i ?
    b. *Who$_i$ does he$_i$ think [$_{CP}$ t_i' [$_{IP}$ they like t_i]] ?
    c. *Who$_i$ did the police accuse him$_i$ of trying to enrich t_i ?

In (1-abc), the pronoun cannot be interpreted as a variable, bound by the *wh*-operator. Following Chomsky (1981, p. 158 & pp. 193ff), it is widely held that strong crossover phenomena can be accounted for by subsuming traces of *wh*-movement under principle C of the binding theory. If t_i in (1-abc) can be classified as a variable (under some appropriate classification of empty categories), and variables may not be A-bound, the strong crossover facts are explained. In the framework of Chomsky (1981), the idea that binding theory is relevant for traces is supported by the fact that traces of A-movement (anaphoric traces) seem to obey a principle of binding theory as well, albeit principle A in this case. Thus, so-called super-raising constructions as in (2) (cf. also Lasnik (1985), Chomsky (1986)) are excluded since the anaphoric traces t_i are not bound within their governing categories (which is the minimal IP in each case). Therefore, they induce a violation of principle A:

(2) a. *A man$_i$ seems [$_{IP}$ there to be killed t_i]
    b. *A man$_i$ seems [$_{CP}$ that there was killed t_i]

c. *John$_i$ seems [$_{CP}$ that it is likely [$_{IP}$ t_i to win]]

However, Chomsky (1986, pp. 74ff), Rizzi (1990, p. 10 & pp. 83ff), Cinque (1990, ch. 1.4.6) and others have argued that principle A is superfluous as a constraint on traces of A-movement, since all the relevant data can be made to follow from an appropriately revised ECP (which, inter alia, requires antecedent-government for traces of A-movement). But this means that binding theory could turn out to be irrelevant for the distribution of traces, if another way were to be found to account for the strong crossover effects illustrated in (1). Also, the idea that the ungrammaticality of (1) can be traced back to a violation of principle C is rendered dubious by the fact that a similar crossover effect occurs in constructions which do not permit an application of principle C. I turn to this issue in the next section.

2. Crossover, A-Movement, and Head Movement

Rizzi (1986, p. 71) discusses Italian examples like the following:

(3) a. Gianni$_i$ è stato [$_{VP}$ affidato t_i a se stesso$_i$]
Gianni was entrusted to REFL
b. *Gianni$_i$ si$_i$ è stato [$_{VP}$ affidato t_i t_i']
Gianni REFL was entrusted

In (3-a), there is A-movement (due to passivization) into the SpecI position, and anaphoric binding of an indirect object (henceforth IO) which is c-commanded by both *Gianni* and its trace in the position of the direct object (DO). (3-b) shows that the co-occurrence of A-movement (of *Gianni*) and cliticization of the IO anaphor to I results in ungrammaticality. Rizzi accounts for this apparent crossover effect by assuming the following chain formation algorithm (cf. Rizzi (1986, p. 66), and for a similar concept of 'chain,' Chomsky (1981, p. 333)):

(4) *Chain:*
C = $\langle \alpha_1,\ldots,\alpha_n \rangle$ is a chain iff, for $1 \leq i < n$, α_i is the local binder of α_{i+1}.

This definition has the effect that it postulates a local binding constraint on chain formation. In particular, even 'intervening' co-indexed elements will now have to enter a chain they intuitively do not belong to. If the intervening element occupies a θ-position, the resulting chain will

invariably violate the θ-criterion of Chomsky (1981), since it contains two θ-roles.

As concerns the sentences in (3), it is obvious that the chain formation algorithm makes the correct predictions. In (3-a), there are two chains $\langle Gianni_i, t_i \rangle$ and $\langle se\ stesso_i \rangle$, which are both well-formed. However, in (3-b), t_i and t_i' enter the same chain, due to the local binding requirement in (4). (These traces are not arguments by themselves; hence, they have to find one, and chain formation starts, according to (4).) Both t_i (the trace of the passive subject *Gianni*) and t_i' (the trace of the IO clitic *si* which has undergone head movement to I) occupy θ-positions, according to Rizzi. Thus, a violation of the θ-criterion results.

However, there is empirical evidence which casts doubt on Rizzi's account of (3-b). As noted by Chomsky (1982), Mahajan (1990, sect. 1.2), and Chomsky & Lasnik (1991, sect. 3.1), among others, A-movement across an IO anaphor or reciprocal is grammatical in English, which is entirely unexpected under Rizzi's assumptions. Cf. the following examples which involve raising:

(5) a. $John_i$ seems to $himself_i$ $[_{IP}\ t_i$ to have shot Bill]
    b. $They_i$ seem to $each\ other_i$ $[_{IP}\ t_i$ to be happy]

Rizzi (1986, p. 76) acknowledges this problem. He suggests that the reciprocal does not enter the chain of *they* in (5) according to the definition of chain in (4), since it is embedded in a PP, headed by *to*, which blocks c-command of t_i by *each other*. The English preposition *to* in (5), though, is semantically empty -- obviously, its only raison d'être is to provide Case for the IO. Hence, it does not come as a surprise that *to*, as a mere Case-assigner, does in general not block c-command by an element it assigns Case to (cf. (6-a)); moreover, the same goes for the Italian equivalent *a* (cf. (6-b)):

(6) a. I will speak $[_{PP}$ to $Gianni_i$] $[_{PP}$ about $himself_i$]
    b. Parlerò $[_{PP}$ a $Gianni_i$] $[_{PP}$ di $sè_i$]

Rizzi notes this fact in a footnote, but does not present a convincing solution. Be this as it may, it is worth noting that there are constructions in German which are parallel to (5) in all relevant respects, the main difference being that no Case-assigning preposition is present to support the IO anaphor. These examples are grammatical, and so clearly indicate that Rizzi's (1986) (or Chomsky's (1981), for that matter) chain

formation algorithm is too strong as it stands. Thus, consider first examples involving raising of the subject of an AP small clause, which is embedded by an ergative, i.e. unaccusative, verb. As pointed out by Sternefeld (1985, 1991), this instance of A-movement may cross a co-indexed IO anaphor, and thus contradicts the chain formation algorithm:

(7) a. dass der Fritz$_i$ sich$_i$ [$_{AP}$ t$_i$ blöd] vorkommt
that ART Fritz REFL stupid appears/strikes-as
b. dass alle$_i$ sich [$_{AP}$ t$_i$ ziemlich unglücklich] vorkamen
that all REFL rather unhappy appeared

Similarly, German allows for subject raising across a so-called 'free dative' (see below) anaphor or reciprocal in *scheinen*- ('seem'-) constructions, just like English does:[1]

(8) a. dass der Fritz$_i$ sich$_i$ [$_{IP}$ t$_i$ schlau zu sein] schien
that ART Fritz REFL sly to be seemed
b. dass die Teilnehmer$_i$ einander$_i$ [$_{IP}$ t$_i$ unglücklich zu sein] schienen
that the participants RECIP unhappy to be seemed

Furthermore, there are other constructions in German which should violate the θ-criterion according to Rizzi's chain formation algorithm, but are grammatical nonetheless. Consider, e.g., the case of A-movement across a co-indexed 'logical subject' anaphor in passive constructions:

(9) a. dass kein Agent$_i$ je von sich$_i$ (selbst) t$_i$ verraten wurde$_{i(?)}$
that no agent$_{nom}$ ever by REFL betrayed PASS
b. dass Fritz$_i$ von sich$_i$ (selbst) t$_i$ reingelegt wurde$_{i(?)}$
that Fritz$_{nom}$ by REFL cheated PASS
c. Der Kandidat$_i$ wurde$_{i(?)}$ von sich$_i$ (selber) t$_i$ vorgeschlagen
the candidate$_{nom}$ PASS by REFL nominated

Here, Case-driven movement of the THEME argument to SpecI does not exhibit a crossover effect, although a co-indexed argument intervenes between the derived subject and its trace -- crossing occurs, either because the passive morphology (which I take to be the passive auxiliary *werden*) directly bears the θ-role of the 'suppressed' AGENT argument (as argued by Baker, Johnson & Roberts (1989)), and thus is co-indexed with the A-movement chain; or because the *von*- ('by-') phrase does not block c-command, as evidenced by examples like *ein Buch von Hans$_i$ über sich$_i$* ('a book by John about himself').

In the same vein, psych-verbs in German pose empirical problems for the definition of chain in (4). Given that the subject position in psych-verb constructions is a non-θ-position in German (i.e., that the THEME argument is base-generated VP-internally; cf. Brandner & Fanselow (1990) and Fanselow (1991)), and that the EXPERIENCER argument asymmetrically c-commands the THEME argument at D-structure (cf. Belletti & Rizzi (1988)), A-movement of the THEME into the SpecI position across a co-indexed EXPERIENCER anaphor should result in ungrammaticality, according to (4). This is not the case:

(10) a. dass Antje$_i$ [$_{VP}$ sich$_i$ [$_{V'}$ t_i mit ihrer neuen Frisur sehr gefällt]]
that Antje(THEME) REFL(EXP) with her new haircut much appeals
b. Am Ende hat Arnim$_i$ nur sich$_i$ (selbst) t_i irritiert
in the end has Arnim(THEME) only REFL(EXP) irritated

Finally, consider passivization in DOCs. In German, there are two passive auxiliaries, viz. *werden*, which absorbs structural accusative Case, and *kriegen* (or *bekommen*), which absorbs structural dative Case, as it occurs in DOCs in German (cf. Reis (1985) and Czepluch (1988), among others, for arguments that the dative is a structural Case here). Hence, with *werden* as passive auxiliary, the THEME argument undergoes Case-driven movement to SpecI, whereas with *kriegen*, it is the GOAL argument (which typically receives structural dative Case in active DOCs) that raises. Interestingly, the remaining VP-internal argument (the GOAL with *werden* in (11-a), and the THEME with *kriegen* in (11-b)) may be a co-indexed anaphor in both cases, without inducing a crossover effect. Hence, whatever relative D-structural hierarchical order of THEME and GOAL one assumes in the case of DOCs (cf. the next section), at least one of the following two examples should violate the θ-criterion, according to Rizzi (1986):

(11) a. dass der Fritz$_i$ [$_{VP}$ t_i? sich$_i$ (selbst) t_i? zugeordnet] wird
that ART Fritz(THEME) REFL(GOAL) assigned $PASS_1$
b. dass der Fritz$_i$ [$_{VP}$ t_i? sich$_i$ (selbst) t_i? zugeordnet] kriegt
that ART Fritz(GOAL) REFL(THEME) assigned $PASS_2$

The examples in (5) and (7)-(11) are fully compatible with binding theory (note that the anaphors are all A-bound within their respective governing categories); their grammaticality suggests that the local binding constraint on chain formation should be dispensed with if an alternative explanation for the Italian example (3-b) can be found.[2] Note that this line of reasoning is in complete accordance with Chomsky (1986a, pp. 181ff), who maintains that ideally, there should not be any special

constraints on chain formation in the first place, and that the cases where a chain formation algorithm seems to be necessary 'may be derivable from independent assumptions.'[3]

If one considers more closely the examples in (3-b), (5), and (7)-(11), it turns out that (3-b) differs from all the other cases of A-movement across a co-indexed anaphor in one crucial respect -- it involves *two* movement chains, viz. an A-chain and an X^0-chain. In (5) and (7)-(11), the anaphoric element has not undergone movement; the German anaphor *sich* and the English anaphor *him-/herself* differ from Italian *si* in not being clitics, i.e. heads, but rather full NPs.[4] From this I conclude that A-movement per se does not induce crossover effects, whereas head movement does. Hence, head movement of *si* in (3-b) illegitimately crosses a co-indexed trace of the derived subject; no such crossover occurs in the German and English examples.

3. Crossover, Dative Movement, and Scrambling

3.1. The Structure of Double Object Constructions

Now consider (12-a) and (12-b), which I take to be the structure of DOCs in the Germanic SOV and SVO languages, respectively:

(12) a. $[_{IP}$ subject $[_{VP1}$ α $[_{VP2}$ β (DO) $[_{V'}$ δ (IO) $[_{V'}$ Γ V $]]]$ $[_{v}$ ϕ $]$ $]$ I $]$

b. $[_{IP}$ subject I $[_{VP1}$ α $[_{v}$ ϕ $]$ $[_{VP2}$ β (DO) $[_{V'}$ δ (IO) $[_{V'}$ Γ V $]]]$ $]]$

Following Larson (1988, 1990), I assume that a 'VP-shell' ($=VP_1$) with an empty head ϕ intervenes between IP and VP ($=VP_2$) in DOCs. Suppose now that, contra Larson, agentive subjects are base-generated in SpecI; that THEME DOs are base-generated in β ($=SpecVP_2$); that δ is the D-structural position of GOAL IOs; and finally, that prepositional arguments of the verb and certain adjunct PPs (such as local, directional, and manner adverbs) are located in Γ, a type of position that arises due to the option of V' recursion in the base. All other adverbs are adjoined to VP or IP. Note that under these assumptions, arguments can never be located in α (the specifier of the VP-shell) at D-structure. Hence, this position is an A-bar position. As noted in section 2, both dative and accusative in DOCs are structural Cases in German. Now, suppose that structural Case, in contrast to inherent Case, can generally only be assigned to a specifier position, under agreement with the Case-assigning head (cf., e.g., Chomsky & Lasnik (1991)). Suppose further that accusative Case is assigned to β, and that α

in (12) is just the position where structural dative Case can be assigned, after V-raising to the empty head of the VP-shell.[5] Then, it follows that at S-structure, Case-dependent IOs cannot show up in the position where they are base-generated (i.e., in the non-specifier δ, where structural Case is not assigned), and must raise to α, where they receive Case under spec/head-agreement (unless there is some other way for them to get Case). Thus, a dative NP in DOCs always occupies a derived A-bar position, both to the left of and higher than the position where accusative objects are generated. The latter position, in turn, precedes and c-commands PP-arguments and VP-internal non-arguments. Then, typical instances of shifted and non-shifted versions of DOCs in German look like this:

(13) a. dass der Fritz $[_{VP}$ -- $[_{VP}$ $[_{NP}$ einen Brief] $[_{V'}$ $[_{PP}$ an den Vermieter]]]
that ART Fritz$_{nom}$ a letter$_{acc}$ to the landlord
geschickt] hat
sent has

b. dass der Fritz $[_{VP}$ $[_{NP}$ dem Vermieter]$_i$ $[_{VP}$ $[_{NP}$ einen Brief] $[_{V'}$ t_i]]
that ART Fritz$_{nom}$ the landlord$_{dat}$ a letter$_{acc}$
geschickt] hat
sent has

In (13-a), the IO remains in situ; in order to escape the Case filter, a Case-assigning preposition is inserted. In (13-b), on the other hand, no preposition occurs. Hence, the IO must raise to to SpecVP-shell, in front of the DO, in order to receive Case. Now, as is clear from the structures in (12), I assume that DOCs in German and English differ only minimally, in the direction of government of I (and the empty V head). Some consequences for the analysis of dative movement in English, then, are these: First, I follow Koster (1988) in assuming that there is a 'residual SOV-structure' in the (lower) VP in English. (Interestingly, Klein & Stechow (1991) have argued for the right-headedness of the English VP on independent grounds, which have to do with the scope of adverbials.) Second, I postulate that English has a structural dative Case, which is assigned to α in DOCs constructions, although English does not even have morphological dative Case (anymore). And finally, a uniform analysis of English and German DOCs as involving Case-driven A-bar movement to SpecVP-shell crucially depends on the finite verb leaving the VP(-shell) and adjoining to I in English; i.e., English must have V-to-(V-to-)I movement in the syntax, just like German or French. This is incompatible with the findings of Pollock (1989), but completely in line with the analysis of Ouhalla (1990). Then, DOCs in English receive exactly the same analysis as in German, cf.:

(14) a. John gave$_j$ [$_{VP}$ -- t_j' [$_{VP}$ a book [$_{V'}$ [$_{PP}$ to Mary] t_j]]]
b. John gave$_j$ [$_{VP}$ Mary$_i$ t_j' [$_{VP}$ a book [$_{V'}$ t_i t_j]]]

With these assumptions about DOCs in mind, let us now turn to the issue of VP-internal crossover.

3.2. Crossover and VP-internal Movement

Consider first some data involving anaphoric binding in German. (Data like the following were, to my knowledge, first presented by Grewendorf (1984; 1988, pp. 54ff); they are also discussed by Webelhuth (1989, sect. 6.6) and Santorini (1991), among others.) First note that binding of IO anaphors by DOs (or by subjects) is relatively unproblematic in principle:

(15) a. dass der Arzt$_j$ den Patienten$_j$ sich$_{i/j}$ im Spiegel zeigte
that the doctor$_{nom}$ the patient$_{acc}$ REFL$_{dat}$ in-the mirror showed
b. dass man die Gäste$_i$ einander$_i$ vorgestellt hat
that one$_{nom}$ the guests$_{acc}$ RECIP$_{dat}$ introduced-to has

DO anaphors, however, may generally not be bound by IOs (although they can be bound by subjects).

(16) a. dass der Arzt$_i$ dem Patienten$_j$ sich$_{i/*j}$ im Spiegel zeigte
that the doctor$_{nom}$ the patient$_{dat}$ REFL$_{acc}$ in-the mirror showed
b. *dass man den Gästen$_i$ *einander$_i$ vorgestellt hat
that one$_{nom}$ the guests$_{dat}$ RECIP$_{acc}$ introduced-to has

An explanation for (16) is straightforward, given the above assumptions. The IO bears dative Case. This implies that it has undergone Case-driven movement to the position where dative Case is assigned, i.e., to the specifier of the VP-shell. This position is an A-bar position (albeit one where Case is assigned), and hence, anaphoric binding is impossible from this position. (Note in addition that the trace of the IO, which of course occupies an A-position, cannot bind the DO, due to a lack of c-command.) Finally, binding by the subject is of course possible, since it occupies an A-position (i.e., SpecI), by assumption. So, the relevant part of the structure of, e.g., (16-a) looks like this:

(17) *...[$_{VP}$ IO$_i$ [$_{VP}$ sich$_i$ [$_{V'}$ t_i...]]]...

An explanation for the possibility of anaphoric binding in (15) is slightly

more involved. The data indicate that the DO asymmetrically c-commands the IO anaphor. I have indeed assumed, following Larson (1988), that IOs are base-generated below DOs. But I have also assumed that they are then raised to SpecVP-shell in order to receive structural dative Case (unless they can receive Case from a preposition). Now, imagine that an IO for some reason does not have to receive Case. Then, there is nothing that precludes it from staying in situ, where it could be A-bound by a DO even at S-structure.

With this in mind, consider the following data on passivization in German:

(18) a. *dass *den Fritz* jetzt gewaschen wird
that ART Fritz_{acc} now washed PASS
b. dass *sich* jetzt gewaschen wird
that REFL now washed PASS

(19) a. *Hier wird *den Fritz* nicht verprügelt
here PASS ART Fritz_{acc} not beaten
b. Hier wird *einander* nicht verprügelt
here PASS RECIP not beaten

Apparently, anaphoric *sich* and reciprocal *each other* are not affected by Case-absorption in the passive (cf. (18-b) & (19-b)), in contrast to other NPs (cf. (18-a) & (19-a)). I conclude from this that these items do not need Case in the first place, and therefore are immune to Case-absorption. So, assuming that the German anaphoric expressions *sich* and *einander* generally do not need to receive structural Case, the reflexive or reciprocal element in examples like (15) does not have to move to the specifier of the upper VP in order to receive Case. Hence, no movement of either IO or DO is necessary to derive the surface word order; therefore, the relevant configuration of, e.g., (15-a) will be as follows:

(20) ...[$_{VP}$ -- [$_{VP}$ DO_i [$_{V'}$ sich_i...]]]...

The IO anaphor is a daughter of V', and can thus be A-bound within its governing category, either by the subject or by the DO.

At first sight, it looks as though the impossibility of anaphoric binding in (16) (i.e., the ungrammaticality of structures like (17)) could be derived by invoking the chain formation algorithm. But, notwithstanding the problems raised in the previous section, there is evidence that (17) is not to be excluded by some kind of chain formation algorithm. First, note that

similar constructions are completely well-formed in English (cf. Barss & Lasnik (1986)); so, given a Larson-type analysis involving dative movement, there is always crossing of a co-indexed DO anaphor in constructions like the following (example (21-a) is from Barss & Lasnik (1986), (21-b) is provided by Chris Wilder (p.c.)):[6]

(21) a. I showed [$_{VP}$ Mary$_i$ [$_{VP}$ herself$_i$ [$_{V'}$ t$_i$]]]
b. I assigned the twins$_i$ each other$_i$ t$_i$ (as dance partner)

Second, there are some German speakers who actually accept examples like (16-a), with binding of a reflexive pronoun; cf. Frey (1990) or Fanselow (1991). So, there clearly is some parametric variation involved in this construction. This can be accounted for if one assumes that for some German speakers, principle A for lexical anaphors can be fulfilled by binding from either an A-position or a Case-position (such as the specifier of the VP-shell), whereas more rigid speakers of German require strict A-binding for lexical anaphors. (Note, however, that the prohibition against binding of a DO *reciprocal* by an IO appears to be strict in German. This follows if one assumes that the German reciprocal *einander* needs A-binding in the dialects of all speakers.) In English, binding from either a Case-position or an A-position appears to be sufficient for both reflexives and reciprocals.[7] At any rate, these considerations show that structures like (17) must not be excluded by some constraint on chain formation.

Finally, it turns out that configurations like (17) become grammatical as soon as the anaphor is replaced by a pronoun. This, again, strongly suggests that it is binding theory which is responsible for the ungrammaticality of (17), and not some chain formation algorithm. Thus, Grewendorf (1988, pp. 57ff) notes that DO pronominals can be bound by IOs, but not by subjects:

(22) dass der Arzt$_i$ dem Fritz$_j$ ihn$_{j/*i}$ im Spiegel zeigte
that the doctor$_{nom}$ ART Fritz$_{dat}$ him$_{acc}$ in-the mirror showed

Since a Case-dependent IO occupies the specifier of the VP-shell (possibly a higher position, after scrambling or operator movement), and since this position is an A-bar position by assumption, a DO underlying principle B of the binding theory can be bound by an IO preceding and c-commanding it. (It can, of course, still not be bound by a subject, since the latter occupies an A-position, and the pronoun is not A-free within its governing category in this case.) Thus, (23) (which is the relevant part of the structure of (22)) is well-formed, in contrast to (17), although it should violate the

θ-criterion, according to the chain formation algorithm.

(23) ...[$_{VP}$ IO$_i$ [$_{VP}$ ihn$_i$ [$_{V'}$ t$_i$...]]]...

The conclusion to be drawn from this is that dative movement, like A-movement (but in contrast to *wh*-movement and head movement) does not induce crossover effects.[8]

The crucial empirical problem is posed by IO pronominals. They can never corefer with a subject or a DO (cf., again, Grewendorf (1988)):

(24) *dass der Arzt$_i$ den Fritz$_j$ ihm$_{i/j}$ im Spiegel zeigte
that the doctor$_{nom}$ ART Fritz$_{acc}$ him$_{dat}$ in-the mirror showed

As in the case of DO pronouns, the binding of the dative pronoun by the subject necessarily produces an A-binding relation, so that disjoint reference is enforced by principle B. The impossibility of coreference with a DO in (24) does not really come as a surprise either from a pre-theoretical point of view, given the strong tendency of anaphors and pronouns to occur in complementary distribution (at least if they are co-arguments of a verb); cf. (15). But recall what has been said about anaphoric *sich* and *einander* in German -- they do not have to receive Case and may therefore stay in situ even if they are IOs. This does not hold for personal pronouns in German, however: (25-b) shows that pronouns are affected by Case-absorption in the passive (moreover, note that pronouns in German are *overtly* Case-marked, which is a clear indication that they have to receive Case).

(25) a. *dass *den Wagen* jetzt gewaschen wird
that the car$_{acc}$ now washed PASS
b. *dass *ihn* jetzt gewaschen wird
that him now washed PASS

By my previous reasoning, this state of affairs implies that IO pronouns obligatorily undergo raising to the specifier of the VP-shell, where structural dative Case is assigned to them. But then the DO must be scrambled, i.e. adjoined, to VP, to yield the word order in (24). Hence, the relevant configuration in (24) must be the following (with t$_i$ being the trace of the DO, and t$_i$' the trace of the IO):

(26) *...[$_{VP}$ DO$_i$ [$_{VP}$ ihm$_i$ [$_{VP}$ t$_i$ [$_{V'}$ t$_i$'...]]]...

Now it seems that although the dative pronoun is A-bound by the subject, it is no longer A-bound by the DO, and should thus be able to corefer with the latter. Since this is not the case, an independent explanation (independent of a straightforward application of principle B, that is) has to be found for the ungrammaticality of examples like (24).

I think that the key to a solution lies in the fact that (26) involves two different types of movement. On the one hand, there is dative movement of the IO, and on the other hand, there is scrambling of the DO. We have seen above that it looks as though dative movement does not induce crossover effects. Scrambling, however, does. Consider the following examples involving scrambling (27-a) and topicalization (27-b) across a co-indexed pronoun in German:

(27) a. *dass [$_{IP}$ den Fritz$_i$ [$_{IP}$ er$_i$ [$_{VP}$ t$_i$ nicht leiden kann]]]
that ART Fritz$_{acc}$ he$_{nom}$ not like can
b. *Den Fritz$_i$ kann [$_{IP}$ er$_i$ [$_{VP}$ t$_i$ nicht leiden]]
ART Fritz$_{acc}$ can he$_{nom}$ not like

In (27-b), the non-operator *den Fritz* is topicalized (inducing verb-second) across a co-indexed subject pronoun. The pronoun cannot be understood as coreferential in this case. Now, note that the ungrammaticality of (27-b) does not follow in any obvious way from the binding theory for *overt* expressions. Both the pronoun *er* (which is not A-bound at S-structure, since topicalization is A-bar movement), and the referential expression *den Fritz* (which is not bound at all at S-structure) meet the requirements of binding theory (that is, principles B and C, respectively). So, it must be the trace of the topicalized item which induces ungrammaticality in (27-b); and this means that topicalization induces (strong) crossover effects. Precisely the same reasoning applies in the case of scrambling in (27-a). Again, the overt expressions *den Fritz* and *er* fulfill the principles of binding theory at S-structure (given that scrambling is A-bar movement, and hence, does not give rise to A-binding options), so it must be the scrambling trace which induces a crossover effect.

But then, it is evident that it is the scrambling of the DO in (26) as well, which is responsible for the crossover effect. If this conclusion is correct, one would expect that subsequent scrambling of the DO in a structure like (23) (which is well-formed, as it stands) should give rise to ungrammaticality, since it results in a crossover configuration. This prediction is borne out. Examples which differ from (22) only minimally, in that the DO has undergone scrambling to a position in front of the IO, are

completely ungrammatical:

(28) a. *dass der Arzt ihn$_i$ dem Fritz$_i$ im Spiegel zeigte
that the doctor him$_{acc}$ ART Fritz$_{dat}$ in-the mirror showed
b. *dass ihn$_i$ der Arzt dem Fritz$_i$ im Spiegel zeigte
that him$_{acc}$ the doctor ART Fritz$_{dat}$ in-the mirror showed

The DO pronoun is scrambled to VP in (28-a), and scrambled to IP in (28-b). (VP and IP are the two categories where left-adjunction at S-structure, i.e. scrambling, is possible in German, cf. Webelhuth (1989) and Fanselow (1990), among others.) Thus, the relevant structures of (28-a) and (28-b) are (29-a) and (29-b), respectively (with t_i being the trace of the DO, and t_i' the trace of the IO):

(29) a. *...[$_{VP}$ ihn$_i$ [$_{VP}$ IO$_i$ [$_{VP}$ t_i [$_{V'}$ t_i'...]]]]...
b. *...[$_{IP}$ ihn$_i$ [$_{IP}$ subject [$_{VP}$ IO$_i$ [$_{VP}$ t_i [$_{V'}$ t_i'...]]]]]...

It comes as no surprise either that topicalization of the DO has the same effect on a structure like (23) -- it results in a crossover configuration:

(30) *Ihn$_i$ hat der Arzt dem Fritz$_i$ im Spiegel gezeigt
him$_{acc}$ has the doctor ART Fritz$_{dat}$ in-the mirror shown

The relevant structure is very similar to (29-ab):

(31) *[$_{CP}$ Ihn$_i$ ... [$_{IP}$ subject [$_{VP}$ IO$_i$ [$_{VP}$ t_i [$_{V'}$ t_i'...]]]]]...

Summarizing this section, it turns out that dative movement does not induce crossover effects, whereas scrambling and topicalization both do. Given the findings of the previous sections, the following generalization then emerges:

(32) *Movement Types and Crossover:*
a. Case-driven movement (i.e., A-movement and dative movement) does not induce crossover effects.
b. Other movement types (*wh*-movement, scrambling, topicalization, head movement) do induce crossover effects.

Note that this contrast corresponds roughly, but not exactly, to the A-/A-bar movement distinction (the only exception being dative movement, which, as we have seen, is formally an A-bar movement, but shares with A-movement the property of being Case-driven).[9]

Leaving the issue of crossover effects aside for a while, I turn now to cases of improper movement. It will become evident that there is indeed a striking similarity in distribution between crossover and improper movement.

4. Improper Movement

In Müller & Sternefeld (1990), it is argued that there are certain cases of improper movement which are not derivable from principle C of the binding theory. These are accounted for by the following condition, according to which A-bar movement must proceed in a strictly unambiguous manner:

(33) *Principle of Unambiguous Binding (PUB)*:
A variable which is α-bound must be ß-free (where α and ß are different types of positions).

From (33), it follows that A-bar chains must be 'uniform' in the sense that all elements of an A-bar chain $\langle \alpha_1,\ldots,\alpha_{n-1},\alpha_n\rangle$, apart from the last one (i.e., α_n), must occupy the same type of position. For example, if a trace is bound by a *wh*-operator occupying a SpecC position, all intermediate traces (if there are any) must occupy SpecC positions as well (which, inter alia, precludes adjunction to VP in the sense of Chomsky (1986) as a means to circumvent a barrier for *wh*-movement). In the same vein, it follows that if a trace is bound by a lexical antecedent in a scrambling (i.e., left-adjunction) position, all intermediate traces (if there are any) must occupy scrambling positions as well. This unambiguity requirement for variable binding allows for the derivation of a number of differences between certain types of A-bar movement. For instance, the PUB accounts for the fact that scrambling is strictly clause-bound in German (cf. (34-a)), whereas *wh* movement is not (cf (34-b)):

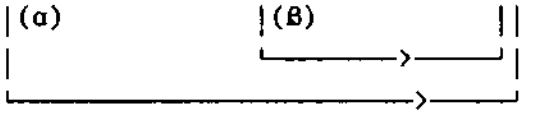
(34) a. *dass der Fritz $[_{VP}\ [_{NP}$ dieses Buch $]_i$ $[_{VP}$ meint $[_{CP}$ (t_i'') dass
that ART Fritz_{nom} this book_{acc} thinks that
$[_{IP}$ t_i' $[_{IP}$ ich t_i lesen sollte $]]]]]$
I_{nom} read should

b. $[_{NP}$ Welches Buch $]_i$ meinst du $[_{CP}$ t_i' dass $[_{IP}$ ich t_i lesen sollte $]]$?
which book_{acc} think you_{nom} that I_{nom} read should .

Under the assumptions a) that CP is a barrier for everything which does not occupy SpecC, whereas IP and VP are generally not barriers (which follows

from the theory of barriers presupposed by Müller & Sternefeld (1990)), b) that all traces must be antecedent-governed, and c) that traces of scrambling chains may never be deleted, the contrast in (34) follows from the PUB. Only in (34-b) may successive-cyclic movement proceed via the escape hatch SpecC -- t_i is unambiguously bound by elements in SpecC positions here. In (34-a), on the other hand, an intermediate trace in SpecC (t_i'') would induce a PUB violation (since t_i would be simultaneously bound by two elements which occupy different types of position -- viz., the head of the chain which is adjoined to VP, and the intermediate trace in SpecC):

(35) *[$_{VP}$ dieses Buch$_i$ ... [$_{CP}$ t_i'' C [$_{IP}$ ... t_i ...]]]



Hence, SpecC must remain empty in (34-a), and an intermediate trace adjoined to IP (which is compatible with the PUB) is separated from its antecedent by a CP barrier, thus violating the ECP.

Similarly, the impossibility of scrambling of *wh*-phrases in German (cf. Fanselow (1990)) is derived. Cf.:

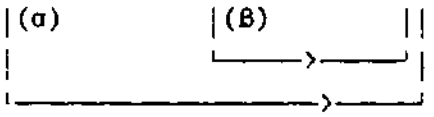
(36) a. Ich weiss nicht [$_{CP}$ wann$_j$ der Fritz [$_{VP}$ t_j was getan hat]]
I know not when ART Fritz$_{nom}$ what$_{acc}$ done has

b. ?*Ich weiss nicht [$_{CP}$ wann$_j$ [$_{IP}$ was$_i$ [$_{IP}$ der Fritz t_j t_i getan hat]]]
I know not when what$_{acc}$ ART Fritz$_{nom}$ done has

c. Ich weiss nicht [$_{CP}$ wann$_j$ [$_{IP}$ das$_i$ [$_{IP}$ der Fritz t_j t_i getan hat]]]
I know not when that$_{acc}$ ART Fritz$_{nom}$ done has

(36-a) is an embedded multiple *wh*-question in German. One *wh*-phrase has undergone movement to SpecC, the other one stays in situ, and the sentence is well-formed. In (36-b), however, the second *wh*-phrase has undergone scrambling. (36-c) shows that there is no general prohibition against scrambling in *wh*-questions in German. So, it must be the scrambling of the *wh*-phrase per se which induces ungrammaticality. This follows from the PUB, given that there is subsequent LF-movement of the *wh*-phrase *was* in (36-b). For in this case, a configuration like (37) arises at LF, which involves ambiguous binding of the variable in DO position (t_i is bound from a scrambling position by t_i', and from SpecC by *was*$_i$):

(37) *...[$_{CP}$ [$_{Specc}$ ... was$_i$] C [$_{IP}$ t_i' [$_{IP}$ ... t_i ...]]] (LF)



This may suffice as an illustration of how the PUB blocks cases of improper movement which are not reducible to principle C. It should be noted, though, that the PUB does not only require traces of scrambling (cf. (35)) and traces of *wh*-movement (cf. (37)) to be unambiguously bound. Similarly, the PUB can be shown to explain the peculiar behaviour of topicalization as compared to both *wh*-movement and scrambling. This is accounted for in Müller & Sternefeld (1990, ch. 3) by a conspiracy of a) the PUB, and b) an auxiliary assumption according to which topicalized phrases are not in SpecC, but rather in the specifier position of a 'verbal' complementizer (viz., the landing site of verb-second movement) in the Germanic languages. Finally, note that the restriction banning movement of a lexical head through a functional category into another lexical category (cf. Li (1990)) is argued also to follow from the PUB, given that traces of head movement are variables.

However, the PUB obviously may not be regarded as a constraint on traces of A-movement, for otherwise, A-movement could never be followed by A-bar movement, which is of course not the case:

(38) a. Who$_i$ [$_{IP}$ t_i' was kissed t_i] ?
b. Who$_i$ [$_{IP}$ t_i'' seems [$_{IP}$ t_i' to have been kissed t_i]] ?

Similarly, the PUB does not apply to traces of dative movement -- in many languages, dative movement may be followed by A-bar movement. As an illustration, consider the following examples from German:

(39) a. Wem$_i$ hat der Fritz [$_{VP}$ t_i' [$_{VP}$ ein Buch [$_{V'}$ t_i]] gegeben] ?
who$_{dat}$ has ART Fritz$_{nom}$ a book$_{acc}$ given
b. Niemandem$_i$ hat der Fritz [$_{VP}$ t_i' [$_{VP}$ ein Buch [$_{V'}$ t_i]] gegeben]
no-one$_{dat}$ has ART Fritz$_{nom}$ a book$_{acc}$ given
c. dass dem Wolfgang$_i$ der Fritz [$_{VP}$ t_i' [$_{VP}$ ein Buch t_i]] gab
that ART Wolfgang$_{dat}$ ART Fritz$_{nom}$ a book$_{acc}$ gave
d. Wem$_i$ meinst du [$_{CP}$ t_i'' dass der Fritz [$_{VP}$ t_i' [$_{VP}$ ein Buch
who$_{dat}$ think you that ART Fritz$_{nom}$ a book$_{acc}$
[$_{V'}$ t_i]] gegeben] hat] ?
given has

These sentences show that all types of A-bar movement may operate on the output of dative movement in German (viz., *wh*-movement in (39-a), scrambling in (39-b), topicalization in (39-c), and even long-distance *wh*-movement in (39-d)). In the same vein, IOs which have first undergone dative movement may then be subject to A-bar movement in Danish (cf. Vikner (1990, sect. 4.3.2)), or in Norwegian (cf. Larson (1988, p. 356) and literature cited there).[10]

In conclusion, the PUB precludes constructions involving improper movement in the case of *wh*-movement, scrambling, topicalization, and head movement, but does not apply to A-movement or dative movement (with the proviso made in the last note). Thus, we end up with the following generalization:

(40) *Movement Types and Unambiguous Binding:*
   a. Case-driven movement (i.e., A-movement and dative movement) is not restricted by the PUB.
   b. Other movement types (*wh*-movement, scrambling, topicalization, head movement) are restricted by the PUB.

A comparison of (40) and (32) strongly suggests that 'being restricted by the PUB' and 'inducing crossover effects' amount to being one and the same property of movement types. Hence it seems that a generalization would be lost if the two notions are not directly related to each other. Since I take the PUB to be well-confirmed as a constraint against improper movement, the task now is to modify this principle in such a way as to account for crossover effects.

5. Crossover and Unambiguous Binding

As it turns out, this task can be achieved in a rather straightforward manner. There is one issue, however, that first needs to be clarified. A prerequisite for a PUB-related approach to crossover phenomena to work properly is the assumption that, contrary to what is argued for by Rizzi (1986) or Chomsky (1981), there are no specific constraints on chain formation. (Since I have shown in sections 2 & 3 that there are a number of empirical problems for a chain formation algorithm along the lines of Rizzi (1986), this move is of course empirically motivated as well.) Instead, I will adopt the theory of 'free chain formation' advocated, e.g., by Chomsky (1986a) and Sternefeld (1991). Sternefeld explicitly argues that chain formation should be 'free' in the sense that it requires only co-indexation and c-command. A conspiracy of θ-theory, binding theory, the ECP, and other

principles of grammar will then ensure that each element enters into its intuitively correct chain at S-structure. Furthermore, I assume that the concept of 'chain' is generalized so as to subsume chains resulting from *wh*-movement, topicalization, scrambling, head movement, and dative movement, in addition to A-movement chains.

This can be accomplished in several ways. In order to induce (free) chain formation in the case of A-bar movement types like scrambling and *wh*-movement, it suffices to assume, contra Chomsky (1981), that XP-traces of A-bar movement are not arguments. Then, chain formation is enforced, since the antecedent (which is an argument) must occur in a chain together with the trace in A-position (which receives the respective θ-role). Similarly, it is plausible to assume that X^0-traces and adjunct traces, too, induce chain formation, which may only stop in case their overt antecedent (viz., the lexical category which has undergone incorporation, and the adjunct, respectively) has entered the chain. In general, *all* traces must occur in a chain the head of which is the moved item, in derivational terms (possibly because traces must derive φ-features from their antecedents, cf. Fanselow's (1991)). This means that, according to the theory of free chain formation, there exist 'generalized chains' of the type $\langle\alpha_1,\ldots,\alpha_n\rangle$, where α_1, the head of the chain, is the moved item in A- or A-bar position, α_n is the trace in the D-structural position of α_1, α_i $(1\leq i<n)$ binds α_{i+1}, and there is transmission of φ-features from α_1 to all α_j's $(1<j\leq n)$. That said, I will now show how the PUB accounts for crossover effects.

In Müller & Sternefeld (1990), the PUB is conceived of as a constraint on A-bar movement (or A-bar chains). It is formulated as a constraint on representations, but it could equally well have been written down as a derivational constraint. Now, let us tackle the issue from a somewhat different angle, and assume that the PUB is to be viewed as a purely representational constraint which guarantees the unambiguous identification of a certain kind of trace, viz. variables. Given the generalized notion of variable in (41), the PUB requires unambiguous binding of exactly those traces which are not the result of Case-driven movement.

(41) *Variable:*
A trace is variable unless it is an NP without Case.

Now, a PUB violation will occur if a trace which is not the result of Case-driven movement is bound by two elements which occupy distinct positions, irrespective of the status of the binders. So conceived, *improper movement* (as in the cases dicsussed in Müller & Sternefeld (1990)) can be traced

back to ambiguous binding of a variable by two elements of *one and the same* chain, whereas a *crossover effect* (as in the examples presented in sections 1 through 3 of this paper) will arise if there is ambiguous binding of a variable by two elements which occur in *different* chains. To see this, consider first crossover effects induced by *wh*-movement, as discussed in section 1. Since *wh*-movement leaves behind a variable, configurations like (42) are excluded by the PUB, because t_i is ambiguously bound by its chain antecedent, which occupies a SpecC position, as well as by the intervening pronoun, which occupies a different position within IP (e.g., SpecI):

(42) *[$_{CP}$ *wh*$_i$ [$_{IP}$ ... pronoun$_i$ ... t_i ...]] ... (where the pronoun c-commands t_i)

Hence, no resort to principle C of the binding theory is necessary, in order to rule out (42). (Then, given the possibility of deriving principle A effects for traces from the ECP, it seems that binding theory, insofar as it restricts the occurrence of traces, can be entirely dispensed with. This would surely be a welcome result since it would simplify the overall theory.) Turning now to the data discussed in section 2, the conclusion reached there was that A-movement per se does not induce crossover effects, whereas head movement does. The relevant configurations are as follows:

(43) a. *... [$_{IP}$ NP$_i$ REFL$_i$-I [$_{VP}$ t_i [$_{V'}$ ... t_i' ... (Italian)
b. ... [$_{IP}$ NP$_i$ ... [$_{VP}$ REFL$_i$ [$_{V'}$ ... t_i ... (German, English)

(43-a) represents the case of ungrammatical *si*-cliticization in Italian (cf. (3-b)), whereas (43-b) corresponds to the examples (5) and (7)-(11), where A-movement across a co-indexed anaphor is possible. According to the PUB, (43-b) is well-formed, since t_i, the trace of A-movement, does not bear Case. Hence, it is not a variable, and does not have to be unambiguously bound. The same goes for the trace t_i in (43-a) -- being a trace of A-movement, it does not have to obey the PUB. The X^0-trace t_i', however, is a variable according to (41) (since it is not an NP without Case), and hence, must fulfill the PUB, which it doesn't since it is bound both by t_i, the trace of NP$_i$, and by its chain antecedent, the reflexive clitic *si* (and the latter two elements clearly occupy distinct positions).

Consider now the crossover effects presented in section 3. The relevant configurations are repeated in (44):

(44) a. */?...[$_{VP}$ IO$_i$ [$_{VP}$ sich$_i$ [$_{V'}$ t_i...]]]... <(17)
b. ...[$_{VP}$ -- [$_{VP}$ DO$_i$ [$_{V'}$ sich$_i$...]]]... <(20)

c. ...[$_{VP}$ IO$_i$ [$_{VP}$ ihn$_i$ [$_{V'}$ t$_i$...]]]... <(23)
d. *...[$_{VP}$ DO$_i$ [$_{VP}$ ihm$_i$ [$_{VP}$ t$_i$ [$_{V'}$ t$_i$'...]]]... <(26)
e. *...[$_{VP}$ ihn$_i$ [$_{VP}$ IO$_i$ [$_{VP}$ t$_i$ [$_{V'}$ t$_i$'...]]]]... <(29-a)
f. *...[$_{IP}$ ihn$_i$ [$_{IP}$ subject [$_{VP}$ IO$_i$ [$_{VP}$ t$_i$ [$_{V'}$ t$_i$'...]]]]]... <(29-b)
g. *[$_{CP}$ Ihn$_i$ ... [$_{IP}$ subject [$_{VP}$ IO$_i$ [$_{VP}$ t$_i$ [$_{V'}$ t$_i$'...]]]]]...<(31)

(44-a) exhibits dative movement across a co-indexed anaphor. This does not violate the PUB, since t$_i$ is an NP trace without Case, hence no variable, and may therefore be bound from two different positions at the same time. (Recall that (44-a) is excluded as a violation of principle A for overt anaphors in the dialect of most speakers of German, but not, e.g., in English).) Anaphoric binding of an IO anaphor by a DO as in (44-b) does not violate the PUB for obvious reasons -- there is no trace present here, according to the assumptions about *sich* made above. As far as dative movement across a co-indexed pronominal as in (44-c) is concerned, there is no violation of the PUB for the very same reasons as in (44-a) -- the trace of the IO is the result of Case-driven movement, and hence, immune to PUB effects. Scrambling of a DO across a co-indexed IO, however, invariably induces a PUB violation, since traces of scrambling chains are variables. This situation obtains in (44-def) (where t$_i$ is the scrambling trace, t$_i$' is the trace of dative movement, and t$_i$ is ambiguously bound, both by its chain antecedent in VP- or IP-adjoined position, and by the IO in SpecVP-shell). Similarly, topicalization of a DO across a co-indexed IO violates the PUB (cf. (44-g)). (The same, of course, goes for scrambling or topicalization across a co-indexed subject, as in (27).)[11]

So, it looks as though all the crossover effects discussed in sections 1 - 3 are accounted for by the PUB. However, there still is one gap in the argumentation, which emerges as soon as the PUB is understood as a purely representational constraint. In Müller & Sternefeld (1990), it is tacitly assumed that the PUB requires unambiguous binding in A-bar *chains* only. But in order to account for crossover effects, it has turned out to be crucial that the PUB does not differentiate between binding by chain-internal and chain-external items. With this in mind, consider the following examples:

(45) a. dass der Fritz$_i$ glaubt [$_{CP}$ dass [$_{IP}$ ihn$_i$ [$_{IP}$ keiner t$_i$ liebt]]]
that ART Fritz believes that him no-one loves
b. dass der Fritz$_i$ glaubt [$_{CP}$ ihn$_i$ würde [$_{IP}$ keiner t$_i$ lieben]]]
that ART Fritz believes him would no-one love

In (45-a), a pronoun has undergone scrambling to IP which is c-commanded by a co-indexed referential expression outside its governing category. (45-b)

instantiates the same case, the only difference being that the pronoun has been topicalized, rather than scrambled. Now, given a strictly representational view of the PUB, (45-ab) should be ruled out since the variable t_i is bound not only by its chain antecedent, but by *der Fritz* in the matrix clause, too. Obviously, variables have to meet the unambiguous binding requirement in a certain local domain only.

Note, however, that this is a problem which is familiar from the discussion of principle C effects with variables in Chomsky (1981, p. 201) and Stechow & Sternefeld (1988, p. 236). (Accordingly, given that t_i in (45) is a variable, it should violate principle C in the classical theory.) Therefore, I suggest a modification of the PUB which is indeed very similar to the one proposed by Chomsky and Stechow & Sternefeld concerning the relevance of principle C for variables:

(46) *Principle of Unambiguous Binding (revised):*
A variable which is α-bound must be β-free *in the domain of the head of its chain* (where α and β are different types of positions).

It can easily be verified that this modification maintains all the PUB-related analyses discussed so far, and no longer excludes examples like (45-ab), since here, the co-indexed NPs in the matrix clause are not in the c-command domain of the head of the scrambling chain.

6. Conclusion

If the approach to crossover phenomena presented in this paper is basically on the right track, the theory of empty categories may be considerably simplified. The distribution of traces is constrained by the theory of locality and proper government on the one hand, and by an unambiguous binding requirement on the other. Invoking principles of binding theory or a local binding constraint on chain formation is not only unnecessary; it is also shown to be misguided in the light of both empirical evidence and theoretical considerations.[12]

Appendix: Intermediate Traces

In section 2, I have pointed out that dative movement, being Case-driven, does not lead to crossover effects. Accordingly, it turned out in section 4 that normally, dative movement does not impose an unambiguous binding

requirement on the (Case-less) trace either (cf. (39)). In note 10, however, I mentioned that A-bar movement may in fact not follow dative movement in some languages, such as (most varieties of) English (cf. Stowell (1981, ch. 4), Czepluch (1982), Kayne (1984), and Larson (1988), among others). Consider some relevant examples:

(47) a. *Who$_i$ did John give [$_{VP}$ t_i' [$_{VP}$ a book [$_{V'}$ t_i]]] ?
b. *Who$_i$ did Mary say [$_{CP}$ t_i'' that she gave [$_{VP}$ t_i' [$_{VP}$ a present [$_{V'}$ t_i]]]] ?

According to Haegeman (1985, p. 284), the same goes for West Flemish:

(48) a. *Wien$_i$ een-ze [$_{VP}$ t_i' [$_{VP}$ nen boek [$_{V'}$ t_i]] gegeven] ?
who$_{dat}$ have-they a book$_{acc}$ given
b. *Eur$_i$ een-ze [$_{VP}$ t_i' [$_{VP}$ nen boek [$_{V'}$ t_i]] gegeven]
her$_{dat}$ have-they a book$_{acc}$ given

However, the analogy with crossover fails in this construction. Dative movement does not induce crossover effects in English; cf. (21), repeated here as (49):

(49) a. I showed [$_{VP}$ Mary$_i$ [$_{VP}$ herself$_i$ [$_{V'}$ t_i]]]
b. I assigned the twins$_i$ each other$_i$ t_i (as dance partner)

From this I conclude that it is unlikely that the ungrammaticality of (47) & (48) is due to a PUB violation of the trace of dative movement. So, the conclusions reached in this paper are not affected.

Now, given this state of affairs, two options arise. Firstly, one could assume that the impossibility of (47) & (48) is due to some independent factor. But it turns out that most of the existing analyses of the phenomenon at hand are either incompatible with the approach to dative movement advocated in this paper (such as Stowell's (1981, ch. 4) analysis according to which dative movement involves raising of the IO into the verb, which then, as an X^0-category, is an island and blocks further movement), or involve a number of otherwise unmotivated assumptions (such as Baker's (1988, pp. 294ff) explanation in terms of his 'non-oblique trace filter,' which blocks A-bar movement of a bare IO NP in a rather ad hoc way). Moreover, the fact that A-bar movement in (47) & (48) is highly local makes it unlikely that a violation of a locality principle (the ECP or the subjacency condition) occurs, and the fact that there is some parametrization involved casts doubt on the idea that there is a general

ban against A-bar movement of a bare dative NP. So I will pursue the second option, which is to treat (47) and (48) as instances of improper movement. But then, two questions must be settled. First, why is there no crossover in dative movement configurations, given that crossover effects and improper movement effects are derived from the same principle? And second, how can one account for the parametric variation, i.e., for the different behaviour of German, Norwegian, and Danish, compared with English and West Flemish?

As a first step towards answering these questions, I propose that, whereas all variables must be unambiguously bound, intermediate traces under certain conditions obey a kind of complementary unambiguous binding requirement, in addition. More specifically, suppose that an intermediate trace which occupies an A-bar position of a certain type must not only *be bound* unambiguously (if it is a variable), but *bind* unambiguously, too -- the determination of exactly which type of A-bar position is relevant here must then be the source of the parametric variation encountered. Thus, consider the following generalization of the PUB:

(50) *Generalized Principle of Unambiguous Binding (informal):*
In the domain of the head of its chain,
a. a variable must be bound unambiguously;
b. an intermediate trace must bind its chain successor unambiguously, if it occupies
(i) a 'strong' A-bar position (where Case cannot be assigned).
(ii) a 'weak' A-bar position (in the classical sense).

(50-a) corresponds to the PUB in (46); (50-b), however, may give rise to additional PUB effects. I assume that α binds β ambiguously, if α binds β, and there is another binder of β which occupies a type of position different from the one occupied by α. Furthermore, I take (i) and (ii) to be parameter values. Recall from the discussion of DOCs in section 3 that it appears to be necessary to distinguish between A-positions in the strict sense, and positions which are either A- or Case-positions, for the purposes of the binding theory. In the same vein, I will now distinguish between 'strong' A-bar positions, i.e. A-bar positions which are not Case-positions (cf. (i)), and 'weak' A-bar positions (where Case may or may not be assigned; cf. (ii)). Then, if a language choses parameter value (i) in (50), intermediate traces in SpecVP-shell do not have to bind unambiguously. Given that this is the case in Danish, German, or Norwegian, dative movement may be followed by a different type of A-bar movement in these languages -- the intermediate trace in SpecVP-shell, being a variable, must

be unambiguously bound (which it is in configurations like (39)), but it does not have to bind unambiguously the trace in the lower VP, because it does not occupy a strong A-bar position. However, if the weaker parameter value (ii) is chosen, as in English or West Flemish, an intermediate trace in SpecVP-shell must bind unambiguously, since it occupies an A-bar position (that SpecVP-shell is a Case-position also does not matter according to (ii)). Hence, subsequent A-bar movement of an IO which has undergone dative movement is prohibited -- t_i' in SpecVP-shell in (47) and (48) does not bind t_i unambiguously, since there is another binder in SpecC which binds t_i. Thus, the parametric variation is accounted for, and the apparent improper movement/crossover asymmetry with dative movement in English is resolved.[13]

At first sight, it might appear that (50-b) is completely superfluous in languages like German, where dative movement may be followed by another type of A-bar movement. Note, however, that there is one case which is not excluded by the PUB in (46), but is excluded by the PUB in (50), viz. successive-cyclic derivations of super-raising constructions. Cf.:

(51) *dass Fritz$_i$ scheint [$_{CP}$ t_i'' dass [$_{IP}$ t_i' t_i geschlagen wurde]]
that Fritz$_{nom}$ seems that hit PASS

Here, neither t_i, nor t_i' or t_i'' violates the PUB in (46) -- all three are NP traces without Case, hence, not variables. But t_i'' is an intermediate trace in a 'strong' A-bar position (SpecC), which does not bind t_i' unambiguously, because the head of the chain *Fritz* occupies a different position (SpecI). Therefore, (51) violates the PUB. Similarly, successive-cyclic derivations of super-raising constructions like (2-bc) in English are ruled out by the generalized PUB, because an intermediate trace in SpecC does not bind unambiguously:

(52) a. *A man$_i$ seems [$_{CP}$ t_i' that there was killed t_i]
b. *John$_i$ seems [$_{CP}$ t_i' that it is likely [$_{IP}$ t_i to win]]

This result may be welcome, for given the option of successive-cyclic movement, it seems to be harder to exclude examples like (2-bc) by means of the ECP, than examples like (2-a) (cf. Chomsky (1986, ch. 11)).[14]

This analysis of improper movement effects in DOCs makes another interesting prediction. If, for some reason, there is evidence that no trace of dative movement exists, movement of an element occupying SpecVP-shell should become grammatical even in English and West Flemish; for no

PUB violation can occur if there is only one trace involved. It seems that this situation obtains in constructions involving so-called 'free' or 'possessive' datives, as in (53) in German:

(53) dass die Antje *dem Carlo* seine Haare schneidet
that ART Antje$_{nom}$ ART Carlo$_{dat}$ his hair$_{acc}$ cuts

Czepluch (1988) and others have convincingly argued that the dative in examples like (53) is a structural Case (note, e.g., that it can be absorbed under passivization, and is in complementary distribution with a GOAL IO bearing dative). On the other hand, it is fairly obvious that *dem Carlo* in (53) is not an argument of the verb (semantically, it modifies the DO *seine Haare*). Therefore, it seems plausible to assume that free dative NPs are directly inserted into the specifier of the VP-shell at D-structure (note that this does not affect the claim that this position is an A-bar position -- a free dative NP is not an argument). The crucial factor, then, is that there is no trace within the lower VP in free dative constructions. According to the above assumptions, this has no effect whatsoever in German-like languages where dative NPs can freely undergo movement. However, there might well be a difference in the mobility of free datives (as opposed to argument datives) in languages where the parameter value (ii) is chosen in (50). At least for West Flemish, this prediction is borne out. Haegeman (1985, p. 295) observes that free datives may in fact undergo A-bar movement, just as one would expect them to do in the present framework -- given that free datives are not derived by dative movement, they cannot induce PUB violations. Cf. (54) (vs. (48)):[15]

(54) a. Wien$_i$ een-ze {$_{VP}$ t$_i$ [$_{VP}$ nen tand] getrokken] ?
who$_{dat}$ have-they$_{nom}$ a tooth$_{acc}$ pulled
b. Eur$_i$ een-ze [$_{VP}$ t$_i$ [$_{VP}$ nen tand] getrokken]
her$_{dat}$ have-they$_{nom}$ a tooth$_{acc}$ pulled

In conclusion, it has proved possible to bar the combination of dative movement and subsequent A-bar movement in some languages by invoking a generalized version of the PUB, without giving up the assumption that crossover effects and improper movement effects should be treated on a par. The resulting system still involves a number of redundancies, since many constructions involving improper movement are excluded now both by (50-a) and (50-b). It may be possible, ultimately, to eliminate these redundancies, However, I will not explore this issue any further here; cf. Fanselow (1991, pp. 100ff) and Müller (i.p., ch. 5) for related discussion.

Notes

1 For arguments that the examples in (7) and (8) truly involve raising to subject position, cf. Sternefeld (1985).

2 In contrast to the literature cited above, Roberts (1991, p. 41) claims that, e.g., subject raising across a co-indexed anaphor as in (5-a) is ungrammatical in English. Furthermore, he argues (pp. 22ff) that (many of) the English pendants of the German A-movement constructions in (7)-(11) are not well-formed either. It should be noted, though, that Roberts seems to acknowledge that the examples of purported A-movement crossover in English are still much better than strong crossover effects with, e.g., *wh*-movement, or crossover effects in *si*-cliticization constructions in Italian (cf. (3-b)) -- a fact which does not follow from his analysis (which applies Rizzi's chain formation algorithm in both cases, cf. the following note). Similarly, some speakers of German appear to think that there is something 'not quite right' with at least some of the examples in (7)-(11). I contend that a slight deviance of the relevant constructions can be traced back to the fact that they are semantically odd (cf. also Sternefeld (1985, pp. 266ff).

3 One might argue that Rizzi's chain formation algorithm is also conceptually problematic, because it does not cover strong crossover effects with *wh*-movement, as it stands (just like principle C does not cover examples like (3-b)). Note, however, that there have been attempts to derive this kind of crossover effect from the chain formation algorithm, too; cf. Lasnik (1985, pp. 487ff), Frampton (1990, p. 60), Fanselow (1991, p. 64), and Roberts (1991, pp. 45ff). But an application of Rizzi's chain formation algorithm to strong crossover phenomena is by no means self-evident. In (1-a), repeated here as (i), t_i, being a variable according to Chomsky (1981), forms a well-formed chain $\langle t_i \rangle$ -- this chain has one argument (recall that variables are arguments in Chomsky's theory), and it has one θ-role only.

(i) *Who$_i$ does she$_i$ like t_i ?

This problem could be solved by assuming, contra Rizzi (1986, p. 66), but following Chomsky (1981, p. 333), that chains have to be maximal. Then, the next A-binder (*she*) enters the chain, and the θ-criterion is violated. However, this explanation does not work in the case of (1-b), repeated here as (ii):

(ii) *Who$_i$ does he$_i$ think [$_{CP}$ t_i' [$_{IP}$ they like t_i]] ?

Here, t_i is locally A-bar bound. According to both Rizzi's and Chomsky's version of the chain formation algorithm, intervening A-bar binders block further chain formation -- *he* does not locally A-bind t_i in (ii). Thus, *he* and t_i do not enter the same chain, and consequently, it is not possible to derive a violation of the θ-criterion. Hence, it is necessary to introduce further modifications, to the effect that the chain formation algorithm is accomodated to crossover in A-bar chains. In particular, the notion 'local binding' must be extended so as to subsume A-bar binding, in addition to A-binding (cf. Lasnik (1985, p. 488)); moreover, it must be guaranteed that in operator/variable structures, chain formation may not stop before the operator has entered the chain of the variable (cf., e.g., Roberts (1991, p. 45), where it is assumed that the bijection principle is a well-formedness condition on chains -- this implies that a variable must form a chain with the operator which binds it).

4 Cf. Vikner & Schwartz (1991) for arguments that German weak pronouns and anaphors do not undergo head movement.

5 In Larson's (1988) theory, the VP-shell has quite a different function -- it defines the position where subjects are base-generated. Moreover,

there may be more than one VP-shell in Larson's theory. For a detailed comparison of Larson's analysis with the approach assumed here, and for a more comprehensive elaboration of an approach to DOCs along the assumptions sketched in the text, cf. Müller (1991, ch. 5) and Müller (1992).

6 Note incidentally that the structures in (21) are not Larson's -- they reflect the assumption made in the last section, that dative movement ends up in SpecVP-shell, and not in SpecVP. It should be kept in mind, though, that this does not bear on the issue discussed in the text -- even in Larson's analysis, the anaphoric DO in (21) asymmetrically c-commands the trace of the IO, and is itself c-commanded by the IO; hence, a violation of the θ-criterion should result in this theory as well, if Rizzi's chain formation algorithm were correct. Cf. (i), which is a Larsonian structure of (21-a):

(i) I_k [$_{VP}$ t_k showed$_j$ [$_{VP}$ Mary$_i$ [$_{V'}$ [$_{V'}$ [$_V$ t_j] t_i] herself$_i$]]]

7 Cf. Mahajan (1990) and Chomsky & Lasnik (1991), among others, for related considerations, to the effect that binding theory may employ the notion 'A-position or Case-position.'

8 Note in passing that incompatibility with the concept of local binding in chain formation is not a specific characteristic of the VP-structure advocated in this paper, but rather directly induced by the data. Webelhuth (1989), Moltmann (1990), and Santorini (1991) (all following Lenerz (1977)) unanimously assume that DOs are base-generated closer to the verb than IOs. Accordingly, they analyze examples like (15) as involving scrambling of the DO, and furthermore assume that scrambling in German is A-movement. Then, a structure like (i) arises, where the DO A-binds the IO:

(i) [$_{VP}$ DO$_i$ [$_{VP}$ sich$_i$ [$_{V'}$ t_i]]]

But movement of a DO across a co-indexed IO should violate the θ-criterion, if Rizzi's chain formation algorithm is valid. The lesson to be learned here is that the theory of chain formation, at least in the version developed by Rizzi and Chomsky, runs into serious problems under any analysis of the binding facts in German DOCs. For it is either the construction in (15), which involves binding of an IO anaphor by a DO, or the one in (22), which exemplifies binding of a DO pronominal by an IO, which is in conflict with the chain formation algorithm, depending on which order of IO and DO in the base one assumes. (For arguments against the proposals by Webelhuth, Santorini, and Moltmann, cf. Müller & Sternefeld (1991); more generally, for arguments against the A-movement approach to scrambling (and in support of an A-bar movement approach), see Saito (1989), Vikner (1990, ch. 4), and Müller & Sternefeld (1991).)

9 I assume, contra, e.g., Chomsky (1986, ch. 11), that head movement is A-bar movement. Given the classical definition of A-movement from Chomsky (1981), to which I will adhere throughout, this follows immediately -- heads can never be moved into positions which can be assigned θ-roles (cf. Baker (1988)). The locality of head movement, then, must be derived without invoking the idea that it is an instance of A-movement. This is accomplished, e.g., by the theories of proper government in Baker (1988) and Rizzi (1990).

10 However, it is well-known that an IO in dative movement configurations may not undergo subsequent A-bar movement for many speakers of English, and the same phenomenon appears in West Flemish (cf. Haegeman (1985)). So, in some languages, it looks as though traces of dative movement are indeed subject to the PUB. I will address this problem in the appendix.

11 There is one case of A-bar movement across a co-indexed item where a

crossover effect does not show up (Sternefeld (1991), Roberts (1991)):

(i) dass [$_{IP}$ sich$_i$ [$_{IP}$ der Fritz$_i$ t_i nicht mag]]
    that REFL ART Fritz$_{nom}$ not likes
(ii) Himself$_i$ [$_{IP}$ John$_i$ doesn't like t_i]

In the German example (i), an anaphor has been scrambled in front of subject; in the English example (ii), an anaphor has been topicalized. Given that *sich* does not need Case in German, we can assume that its trace, although a scrambling trace, does not have to receive Case either, and hence, does not qualify as a variable, subject to the PUB. However, although this would neatly account for the lack of a crossover effect in (i), this analysis does not carry over to (ii). Anaphors in English are overtly Case-marked, and not immune to Case-absorption in the passive; moreover, sentences like (21-a) (*I showed Mary$_i$ herself$_i$*) cannot be interpreted in such a way that *Mary* is the THEME, and *herself* the GOAL argument (cf. (15) in German). Thus, English anaphors must receive Case. I conclude that (i) and (ii) are to be accounted for by whatever explains the option of the anaphors involved to remain unbound at S-structure -- the anaphors in (i) and (ii) behave as if they were in situ, both w.r.t. principle A and the PUB.

12 I have not addressed the issue of weak crossover phenomena in this paper. It might be conceivable to adopt the analysis by Stowell (1991), and incorporate it into the approach pursued here. This should be possible because Stowell assumes that weak crossover effects are due to a violation of more or less the same principle as strong crossover effects. According to Stowell, the index of a bound variable pronoun percolates up to its mother category as a 'secondary' index, and thus induces a principle C violation in the same way that a pronoun in strong crossover environments does, even if there is no binding in the strict sense:

(i) *Who$_i$ does [$_{NP}$ his$_i$ mother$_j$]$_{j<i}$ like t_i ?

I will not adopt such a theory here, though, because there is some evidence that weak crossover effects should be traced back to a licensing violation of the bound variable pronoun, rather than to a licensing violation of the trace; cf. Reinhart (1983), Heim (1989), Mahajan (1990), and Müller (1991, ch. 4).

13 Note in passing that this approach requires an analysis of passivization in DOCs in English according to which A-movement to SpecI of the IO takes place in one step, from the base-position of the IO (as argued by Stowell (1981), Czepluch (1982), and Larson (1988)). If raising to SpecI in (i) were to proceed via the target position of dative movement (SpecVP-shell, according to my assumptions), the sentence would violate the PUB, since t_i' occupies an A-bar position and does not bind t_i unambiguously (the head of the chain *Mary* binds t_i from SpecI):

(i) Mary$_i$ was given [$_{VP}$ (t_i') [$_{VP}$ a book [$_{V'}$ t_i]]]

14 Under this view, sentences like (i), noted in Lasnik (1985, p. 483) as an 'unexpected loophole' for super-raising, do not pose a problem.

(i) *John$_i$ is believed [$_{CP}$ (t_i') (that) [$_{IP}$ he$_i$ likes t_i]]

Lasnik points out that super-raising is not excluded by principle A if movement crosses a co-indexed subject. Thus, in (i), *he* A-binds t_i, which therefore fulfills principle A. But (i) is ruled out by a conspiracy of the PUB and the ECP, just like (2-bc)/(52-ab). If an intermediate trace t_i' in SpecC is present, the generalized PUB is violated; if t_i' does not exist, t_i cannot be antecedent-governed (since antecedent-government requires co-occurrence in a chain, cf.

Chomsky (1986), and *he*, the only potential antecedent-governor, belongs to a different chain), and violates the ECP.

15 In English, the situation is not so clear, since it is doubtful whether English has a free dative construction. However, Chris Wilder (p.c.) observes that (i) (which to a certain extent resembles a free dative construction) is much better than, e.g., (47-a); similarly, (ii) seems to be completely well-formed, which is explained if one assumes that idiomatic expressions like *to give someone the sack* cannot be derived by dative movement.

(i) ?Who$_1$ did you bake [$_{VP}$ t$_1$ [$_{VP}$ a cake]] ?
(ii) Who$_1$ did you give [$_{VP}$ t$_1$ [$_{VP}$ the sack]] ?

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