Constraints in Syntax

[4] Constraints on Binding

SoSe 2005, Universität Leipzig
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1. Principles A, B, C of the Binding Theory

Terminology (Chomsky (1981)):
An item is called *anaphor* if it is a *reflexive pronoun* or a *reciprocal pronoun*. An item is referred to as a *pronoun* if it is a *personal pronoun*. An item is called an *R-expression* ("referential expression") if it has the categorial feature [D] and does not qualify as an anaphor or as a pronoun (in the technical sense). Typically, R-expressions are *names* or *definite DPs*; but they may also include other kinds of DPs.

Note:
These notions are used by the three fundamental constraints of binding theory, viz., Principle A, Principle B, and Principle C. The constraints are representational; for the time being, we can take them to apply to syntactic output (S-structure) representations.

(1) a. *Principle A*^{r}:
An anaphor is bound in its binding domain.
b. *Principle B*^{r}:
A pronoun is not bound in its binding domain.
c. *Principle C*^{r}:
An R-expression is not bound.

Note:
The notions of *binding* and *binding domain* need to be clarified. For present purposes, (2) and (3) will suffice.

(2) *Binding*:
α binds β iff (a), (b), and (c) hold:
a. α and β are co-indexed.
b. α occupies an A-position.
c. α c-commands β.

Question:
What is an A-position? For present purposes, we can assume that A-positions are specifiers of lexical categories (N, V, A, P), and of the functional catgories D and T. SpecC is not an A-position (neither are modifier positions or, irrelevantly, complement positions).

(3) *Binding domain*:

The binding domain of some category α is the minimal XP that dominates a category β ($\beta \neq \alpha$) such that (a) or (b) holds:

a. β is an external argument.
b. β is a finite T.

Note:
In general, principles A and B predict that anaphors and pronouns are in *complementary distribution*. By and large, this seems to be correct (but there are a number of principled exceptions that we will ignore here, in particular in DP-internal contexts).

(4) *Consequences of Principle A*:

a. $[_{CP}$ C $[_{TP}$ John$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ likes himself$_1$]]]]
b. *$[_{CP}$ C $[_{TP}$ John$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ thinks $[_{CP}$ that $[_{TP}$ Mary$_2$ $[_{T'}$ Ø $[_{VP}$ t$_2$ likes himself$_1$]]]]]]]
c. *$[_{CP}$ Fritz$_1$ glaubt $[_{CP}$ dass sich$_1$ dumm ist]]
Fritz$_{nom}$ believes that self stupid is
d. $[_{CP}$ C John$_1$ believes $[_{TP}$ himself$_1$ to be $[_{AP}$ t$_1$ clever]]]
e. John$_1$ likes $[_{DP}$ Ø $[_{NP}$ stories $[_{PP}$ about himself$_1$]]]
f. *John$_1$ likes $[_{DP}$ Bill's$_2$ $[_{NP}$ stories $[_{PP}$ about himself$_1$]]]

(5) *Consequences of Principle B*:

a. *$[_{CP}$ C $[_{TP}$ John$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ likes him$_1$]]]]
b. $[_{CP}$ C $[_{TP}$ John$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ thinks $[_{CP}$ that $[_{TP}$ Mary$_2$ $[_{T'}$ Ø $[_{VP}$ t$_2$ likes him$_1$]]]]]]]
c. $[_{CP}$ Fritz$_1$ glaubt $[_{CP}$ dass er$_1$ dumm ist]]
Fritz$_{nom}$ believes that he stupid is
d. *$[_{CP}$ C John$_1$ believes $[_{TP}$ him$_1$ to be $[_{AP}$ t$_1$ clever]]]
e. ?John$_1$ likes $[_{DP}$ Ø $[_{NP}$ stories $[_{PP}$ about him$_1$]]]
f. John$_1$ likes $[_{DP}$ Bill's$_2$ $[_{NP}$ stories $[_{PP}$ about him$_1$]]]

(6) *Consequences of Principle C*:

a. *$[_{CP}$ C $[_{TP}$ He$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ likes John$_1$]]]]
b. *$[_{CP}$ C $[_{TP}$ He$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ thinks $[_{CP}$ that $[_{TP}$ Mary$_2$ $[_{T'}$ Ø $[_{VP}$ t$_2$ likes John$_1$]]]]]]]
c. *He$_1$ likes $[_{DP}$ Bill's$_2$ $[_{NP}$ stories $[_{PP}$ about John$_1$]]]

2. Levels of Representation

Question:
Is there evidence that, e.g., a representational principle A must apply at S-structure, but not at D-structure or LF? Yes, there is:

(7) *An argument against Principle A at D-structure: Movement to SpecT makes A-binding possible*:

a. *D-structure representation*:
[$_{CP}$ C [$_{TP}$ T [$_{VP}$ [$_{V'}$ seems [$_{PP}$ to himself$_1$]] [$_{TP}$ to be [$_{AP}$ John$_1$ clever]]]]]
b. *S-structure representation*:
[$_{CP}$ C [$_{TP}$ John$_1$ [$_{T'}$ T [$_{VP}$ [$_{V'}$ seems [$_{PP}$ to himself$_1$]] [$_{TP}$ t$'_1$ to be [$_{AP}$ t$_1$ clever]]]]]]

Note:
At D-structure, *himself* is not A-bound; it finds an A-binder only after movement of the DP *John* to the matrix subject position (where [*nom*]/[*D*] on the finite T is deleted).

An independent problem:
The structure of VP adopted here is not unproblematic: It does not matter whether PP is a modifier or optionally selected – it seems clear that TP cannot occupy a complement position. Hence, it should be predicted to be a barrier blocking movement of the DP *John* via the Condition on Extraction Domains. Essentially, this reflects the recurring problem with double object constructions in the present system. Ultimately, the solution will have to be that there is an additional empty verb-like functional head that *seems* raises to by LI-movement in (7). If so, PP can be viewed as a specifier (or modifier), and TP as the complement of *seems* prior to LI-movement to the higher head position.

A remark on notation:
So far, we have assumed that movement leaves a trace that is co-indexed with the moved item. Now we assume that binding also involves co-indexing; but this time, two separate categories are involved that are not related via movement. If the indices for binding and the indices for movement are treated in the same way (and they usually are), ambiguities may arise in syntactic representations. To avoid such ambiguities, a letter (*a* or *b*) is added to indices where needed in what follows. Only those items are related by movement that have an identical letter accompanying the general index – but for the purposes of binding theory, an identical number is sufficient to ensure co-indexing.

(8) *Why Principle A cannot apply (only) at LF: Quantifier raising makes A-binding impossible*:
a. *S-structure representation*:
*[$_{CP}$ C [$_{TP}$ Each other$_1$ [$_{T'}$ T [$_{VP}$ t$_1$ like [$_{DP_1}$ all students]]]]]
b. *Logical Form representation*:
*[$_{CP}$ C [$_{TP}$ [$_{DP_{1/b}}$ all students] [$_{TP}$ each other$_{1/a}$ [$_{T'}$ T [$_{VP}$ t$_{1/a}$ like t$_{1/b}$]]]]]

Note:
This analysis presupposes that quantifier raising (QR) is an LF movement operation that moves quantified phrases like *all students* to an outer SpecT position at LF. Given that SpecT is an A-position, a reciprocal in a lower SpecT would be predicted to be A-bound within TP at LF. Hence, under these assumptions, the evidence in (8) might be taken to suggest that Principle A does not solely apply at LF. (If it applies at S-structure and LF, (8) does not raise

a problem anymore: The derivation is ill formed because there is one level of representation where its output representation violates a constraint.)

3. Problems with Principle A: Legitimate Unbound Anaphors

Note:
Movement operations applying to an anaphor or an XP that contains an anaphor can create contexts in which the anaphor is not bound at S-structure. Hence, we would expect a violation of Principle A^r at S-structure, and therefore ungrammaticality. However, ungrammaticality does not arise in these S-structure configurations (see van Riemsdijk & Williams (1981), Barss (1984; 1986), Chomsky (1995)).

(9) *Topicalization of the anaphor*:
   a. *D-structure representation*:
   $[_{CP}$ C $[_{TP}$ does not really $[_{DP_{1/a}}$ John] like $[_{DP_{1/b}}$ himself]]]
   b. *S-structure representation*:
   $[_{CP}$ $[_{DP_{1/b}}$ Himself] C $[_{TP}$ $[_{DP_{1/a}}$ John] does not really $t_{1/a}$ like $t_{1/b}$]]

(10) *Topicalization or wh-movement of an XP containing the anaphor*:
   a. (i) *D-structure representation*:
   Mary wondered $[_{CP}$ C $[_{TP}$ T $[_{VP}$ $[_{DP_{2/a}}$ Bill] saw $[_{DP_1}$ which picture of $\text{himself}_{2/b}$]]]]
   (ii) *S-structure representation*:
   Mary wondered $[_{CP}$ $[_{DP_1}$ which picture of $\text{himself}_{2/b}$] C $[_{TP}$ $[_{DP_{2/a}}$ Bill] T $[_{VP}$ $t_{2/a}$ saw t_1]]]
   b. (i) *D-structure representation*:
   $[_{CP}$ C $[_{TP}$ does not really $[_{DP_{1/a}}$ John] like $[_{DP_2}$ $[_D$ Ø] books about $[_{DP_{1/b}}$ himself]]]
   (ii) *S-structure representation*:
   $[_{CP}$ $[_{DP_2}$ $[_D$ Ø] Books about $[_{DP_{1/b}}$ himself]] C $[_{TP}$ $[_{DP_{1/a}}$ John] does not really $t_{1/a}$ like t_2]]

Note:
A weaker version of this problem arises if we assume that *wh*-in situ phrases move to a $\text{SpecC}_{[+wh]}$ position at LF, as in (11): The wellformedness of (11) shows that Princile A cannot apply solely at LF, like (8) did.

(11) *LF wh-movement of a wh-phrase containing an anaphor*:
   a. *S-structure representation*:
   Mary wondered $[_{CP}$ $[_{DP_{1/a}}$ who] C $[_{TP}$ $t'_{1/a}$ T $[_{VP}$ $t_{1/a}$ saw $[_{DP_2}$ which picture of $\text{himself}_{1/b}$]]]]
   b. *LF representation*:
   Mary wondered $[_{CP}$ $[_{DP_2}$ which picture of $\text{himself}_{1/b}$] $[_{C'}$ $[_{DP_{1/a}}$ who] C $[_{TP}$ $t'_{1/a}$

T [$_{VP}$ $t_{1/a}$ saw t_2]]]]

Note:
Belletti & Rizzi (1986) observe the same kind of phenomenon in *psych verb* constructions. A basic assumption (for which they provide independent motivation) is that the arguments that act as subjects in these constructions are not the external argument of the psych verb; rather, they are "derived" subjects in the sense that they must move across a higher argument into the subject position, as in (12). (As with double object constructions, problems arise with respect to linear precedence statements unless we are willing to adopt a more complex structure of VP. For now, we put those problems aside.)

(12) *Structure of psych verb constructions*:
[$_{TP}$ [$_{DP_1}$ This picture] T [$_{VP}$ [$_{V'}$ bothers t_1] [$_{DP_2}$ John]]]

(13) *Movement to SpecT of a DP containing an anaphor, English*:
a. *[$_{TP}$ [$_{DP_1}$ Each other's$_2$ parents] T [$_{VP}$ t_1 promised [$_{DP_2}$ the girls] to buy cars]]
b. [$_{TP}$ [$_{DP_1}$ This picture of himself$_2$] T [$_{VP}$ [$_{V'}$ bothers t_1] [$_{DP_2}$ John]]]

(14) *Movement to SpecT of a DP containing an anaphor, Italian*:
a. [$_{TP}$ [$_{DP_1}$ Questi pettegolezzi su di sé$_2$] T [$_{VP}$ [$_{V'}$ preoccupano t_1] Gianni$_2$
these gossips about himself worry Gianni
più di ogni altra cosa]]
more than anything else
b. *[$_{TP}$ [$_{DP_1}$ Questi pettegolezzi su di sé] T [$_{VP}$ t_1 [$_{V'}$ descrivono Gianni$_1$
these gossips about himself describe Gianni
meglio di ogni biografia ufficiale]]]
better than any official biography

Note:
Not only can an anaphor contained in a moved XP escape the structural binding domain of a subject antecedent without inducing ungrammaticality; it can also find a new binder in the matrix clause this way. The ambiguity of examples like (15), (17) thus provides a second argument against assuming that Principle A applies at D-structure (recall (7)), and an argument against assuming that Principle A applies at S-structure (compare (9), (10), (13), (14)).

(15) *Wh-movement to SpecC makes A-binding possible, first example*:
a. *D-structure representation*:
[$_{CP}$ $C_{[-wh]}$ [$_{TP}$ T [$_{VP}$ [$_{DP_1}$ John] wondered [$_{CP}$ $C_{[+wh]}$ [$_{TP}$ T [$_{VP}$ [$_{DP_2}$ Bill] saw [$_{DP_3}$ which picture of himself$_{1,2}$]]]]]]]
b. *S-structure representation*:
[$_{CP}$ $C_{[-wh]}$ [$_{TP}$ [$_{DP_1}$ John] T [$_{VP}$ t_1 wondered [$_{CP}$ [$_{DP_3}$ which picture of himself$_{1,2}$]
$C_{[+wh]}$ [$_{TP}$ [$_{DP_2}$ Bill] T [$_{VP}$ t_2 saw t_3]]]]]]

(16) *Long-distance binding is impossible without movement*:
[$_{CP}$ C$_{[-wh]}$ [$_{TP}$ [$_{DP_1}$ John] T [$_{VP}$ t$_1$ wondered [$_{CP}$ whether [$_{TP}$ [$_{DP_2}$ Bill] T [$_{VP}$ t$_2$ saw [$_{DP_3}$ a picture of himself$_{*1,2}$]]]]]]]

(17) *Wh-movement to SpecC makes A-binding possible, second example*:

a. *D-structure representation*:
[$_{CP}$ C$_{[+wh]}$ [$_{TP}$ does [$_{VP}$ [$_{DP_1}$ John] think [$_{CP}$ [$_{C_{[-wh]}}$ that] [$_{TP}$ T [$_{VP}$ [$_{DP_2}$ Bill] liked [$_{DP_3}$ which picture of himself$_{1,2}$]]]]]]]

b. *S-structure representation*:
[$_{CP}$ [$_{DP_3}$ Which picture of himself$_{1,2}$] [$_{C_{[+wh]}}$ does] [$_{TP}$ [$_{DP_1}$ John] T [$_{VP}$ t$_1$ think [$_{CP}$ t$'_3$ [$_{C_{[-wh]}}$ that] [$_{TP}$ [$_{DP_2}$ Bill] T [$_{VP}$ t$_2$ liked t$_3$]]]]]] ?

(18) *Long-distance binding is impossible without movement*:
[$_{CP}$ C$_{[-wh]}$ [$_{TP}$ [$_{DP_1}$ John] T [$_{VP}$ t$_1$ thinks [$_{CP}$ [$_{C_{[-wh]}}$ that] [$_{TP}$ [$_{DP_2}$ Bill] T [$_{VP}$ t$_2$ liked [$_{DP_3}$ this picture of himself$_{*1,2}$]]]]]]]

Conclusion:
If a representational version of Principle A is to be maintained, it must be revised in such a way that the effects of movement (no loss of binding options after S-structure movement, new binding options may arise after S-structure movement) can be "imitated" by the constraint. Intuitively, the creation of "new" binding options can be taken to support the idea that the constraint applies at S-structure; and the persistence of "old" binding options requires a concept of *reconstruction*. Here is a possible solution (that essentially goes back to Barss (1984); also see Barss (1986) for an even more complicated version of the general idea in terms of so-called *Chain Accessebility Sequences*).

(19) *Principle A^r* (revised):
At S-structure, an anaphor is chain-bound in its binding domain.

(20) *Chain-Binding*:
α chain-binds β iff (a), (b), and (c) hold:

a. α and β are co-indexed.
b. α occupies an A-position.
c. (i) α c-commands β, or
(ii) α c-commands a trace of γ, where $\gamma = \beta$ or γ dominates β.

(21) *Binding domain* (as before):
The binding domain of some category α is the minimal XP that dominates a category β ($\beta \neq \alpha$) such that (a) or (b) holds:

a. β is an external argument in SpecX.
b. β is a finite X.

Note:
There is a potential technical problem: Suppose that an anaphor has been topicalized in a

root clause, as in (9-b), repeated here in (22). Here, the anaphor does not seem to have any binding domain: The only XP that dominates the anaphor is CP, which does not have a β in the sense of (21). How, then can the anaphor in (22) fulfill Principle A in (19)? One assumption could be that the definition of binding domain is modified in such a way that the root CP qualifies as a binding domain if otherwise no binding domain can be determined.

(22) *Topicalization of the anaphor*:
[$_{\text{CP}}$ [$_{\text{DP}_{1/b}}$ Himself] C [$_{\text{TP}}$ [$_{\text{DP}_{1/a}}$ John] does not really $t_{1/a}$ like $t_{1/b}$]]

Question:
Why is there no ambiguity in (23-ab) (see Barss (1986), Huang (1993))?

(23) a. [$_{\text{AP}_3}$ t_1 How proud of himself$_{1/*2}$] did John$_2$ say [$_{\text{CP}}$ t'_3 Bill$_1$ became t_3]?
b. [$_{\text{VP}_3}$ t_1 Criticize himself$_{1,*2}$] John$_2$ thinks [$_{\text{CP}}$ t'_3 Bill$_1$ will not t_3]

Answer:
Recall that the structure of VP and AP is based on the argument structure of V and A, respectively (all arguments of a predicate are merged within that predicate's maximal projection); and that only maximal projections (XP) can undergo *wh*-movement or topicalization to SpecC. Hence, the fronted XPs in (24-ab) have (unbound) traces in specifier position that continue to erect a binding domain for the anaphors after the movement operation.

General problem:
The new representational Principle A is not conceptually attractive because it simply states properties of binding that should independently result from the role of movement in syntax.

4. Problems with Principle C: Illegitimate Unbound R-Expressions

Observation:
Just as movement does not destroy anaphoric options, it does not create new options for R-expressions (or pronouns).

(24) *Topicalization of R-expressions*:
a. *[$_{\text{CP}}$ C [$_{\text{TP}}$ He$_{1/a}$ does not really $t_{1/a}$ like John$_{1/b}$]]
b. *[$_{\text{CP}}$ John$_{1/b}$ C [$_{\text{TP}}$ he$_{1/a}$ does not really $t_{1/a}$ like $t_{1/b}$]]

(25) *Wh-movement of an XP containing the R-expression*:
a. *He$_1$ was willing to discuss [$_{\text{DP}_2}$ the claim [$_{\text{CP}}$ that John$_1$ was asleep]]
b. *[$_{\text{DP}_2}$ Which claim [$_{\text{CP}}$ that John$_1$ was asleep]] was he$_1$ willing to discuss t_2 ?

Note:
Again, a problem arises for the assumption that Principle C applies at S-structure. And again, a reformulation of Principle C that relies on the notion of chain-binding will fix the problem. (Similar conclusions hold for Principle B.)

(26) *Principle C^r* (revised):
An R-expression is not chain-bound.

Note:
However, there is an interesting exception to the generalization that movement does not change binding options for R-expressions. Examples like (27) seem well-formed for many speakers. This is known as an *anti-reconstruction* effect.

(27) *Anti-reconstruction with wh-movement of an XP containing the R-expression*:
*[$_{DP_2}$ Which claim [$_{CP}$ that John$_1$ made]] was he$_1$ willing to discuss t$_2$?

Note:
(25-b) and (27) form a minimal pair. The crucial difference is that CP is an argument of N in (25-b), and a modifier of N in (27).

5. A Derivational Reinterpretation of the Principles of Binding Theory

Note:
Throughout, the system in [1] ("Phrase Structure and Derivations") is adopted again, i.e., Move and Merge alternate throughout a derivation, and sentences grow until they reach the root C.

5.1. Principle C

Note:
Except for (27), Principle C can straightforwardly be reinterpreted as a derivational constraint that holds at every step of the derivation. No recourse to concepts like chain-binding is necessary: As soon as an R-expression is bound, the constraint will be violated, and ungrammaticality arises.

(28) *Principle C^d*:
An R-expression is not bound.

(29) *An illustration of Principle C^d effects*:
a. *[$_{CP}$ C [$_{TP}$ [$_{DP_1}$ He] [$_{T'}$ Ø [$_{VP}$ t$_1$ likes [$_{DP_1}$ John]]]]]
b. *Derivation*:
Merge ([$_V$ likes], [$_{DP_1}$ Ø John]) → [$_{VP}$ [$_V$ likes] [$_{DP_1}$ Ø John]]
c. Merge ([$_{DP_1}$ he], [$_{VP}$ [$_V$ likes] [$_{DP_1}$ Ø John]]) →
*[$_{VP}$ [$_{DP_1}$ he] [$_{V'}$ [$_V$ likes] [$_{DP_1}$ Ø John]]]
(→ Violation of Principle C^d)

Question:
Is there anything that can be done to prevent a violation of Principle C^d in (27)?

Assumption (Freidin (1986), Lebeaux (1988), Chomsky (1995), Epstein et al. (1998)):
Modifiers can be merged counter-cyclically, arguments and other selected items cannot be merged counter-cyclically.

(30) *Strict Cycle Condition*^{d} (revised):
No operation *that involves the deletion of a selectional feature* can apply to a domain dominated by a cyclic node α in such a way as to affect solely a proper subdomain of α dominated by a node β which is also a cyclic node.

Note:
The constraint Timing of Feature Deletion in (29) on page 7 of [1] can actually be viewed as a version of the Strict Cycle Condition that has this effect.

5.2. Principle A

Assumption:
Let us assume that Principle A is a derivational constraint that restricts every syntactic operation.

(31) *Principle A*^{d}:
An anaphor is bound in its binding domain.

Note:
Since anaphors are usually first be merged with a predicate before its antecedent enters the phrase marker (except for cases like (7)), a straightforward derivational reinterpretation of Principle A makes problematic predictions: The anaphor may not have a binding domain yet at the point where it is introduced. But then, a presupposition failure would arise, and Principle A could not be fulfilled.

(32) *A wrong prediction*:
a. $[_{CP}$ C $[_{TP}$ John$_1$ $[_{T'}$ Ø $[_{VP}$ t$_1$ likes himself$_1$]]]]
b. *Derivation*:
Merge ($[_V$ likes], $[_{DP_1}$ himself]) $\rightarrow$ *$[_{VP}$ $[_V$ likes] $[_{DP_1}$ himself]]
($\rightarrow$ Violation of Principle A^d!)

Note:
One might want to fix this problem by revising Principle A^d as in (33):

(33) *Principle A*^{d} (revised):
If an anaphor α has a binding domain β, then α is bound in β.

Consequence:
This still does not help: It will be impossible for an anaphor to extend its binding domain (and find an antecedent in a higher clause) by movement; but this is needed for cases like (15), (17).

Conclusion:
The problem with Principle A^d in (31)/(33) is that it is assumed to hold at every derivational step. The *universal quantification* embodied in this assumption works well for constraints like Principle B and Principle C (and for locality constraints like those discussed in [2] and [3]), but not for a constraint like Principle A. Here, an *existential quantification* is needed, as in (34) (see Belletti & Rizzi (1986), Epstein et al. (1998)).

(34) *Principle A^g* (second revision):
An anaphor is bound in its binding domain at some point of the derivation.

Note:
This accounts for all the data discussed so far. However, it seems that (34) cannot simply be checked at any given step of the derivation. Rather, the whole derivation must be considered, and there must be at least one step where the anaphor is bound within its binding domain. Hence, (34) does in fact qualify as a global constraint; it is not local anymore.

(35) *A final interesting example*:
Mary wondered $[_{CP}\ [_{DP_3}$ which claim $[_{CP}$ that pictures of herself disturbed Bill]] he made t_3]