Introduction to Transformational Grammar, LINGUIST 601
December 8, 2004

Crossover Phenomena and Variable Binding

1 Strong Crossover

Strong Crossover: a pronoun cannot bind a *wh*-chain it c-commands.

(1) SCO with questions:

a. *Who$_i$ does he$_i$ think [t$_i$ won the game]?
(* bad on the reading: who is such that he thinks that he won the game? *)

b. Who$_i$ t$_i$ thinks that he$_i$ left?

c. *Who$_i$ does he$_i$ think [you saw t$_i$]?
(* bad on the reading: who is such that he thinks that you saw him? *)

d. Who$_i$ t$_i$ thinks that you saw him$_i$?

(2) SCO with relative clauses:

a. The man [who$_i$ [he$_i$ thinks [t$_i$ won the game]]]
(* bad on the reading: the man such that he thinks that he won the game *)

b. The man [who$_i$ [t$_i$ thinks [he$_i$ won the game]]]

c. The man [who$_i$ [he$_i$ thinks [you saw t$_i$]]]
(* bad on the reading: the man such that he thinks that you saw him *)

d. The man [who$_i$ [t$_i$ thinks [you saw him$_i$]]]

1.1 A Reduction to Binding Theory

(3) The SCO configuration: *Op$_i$ ... pron$_i$ ... x$_i$
(where Op$_i$ c-commands pron$_i$ and pron$_i$ c-commands x$_i$)

A popular explanation for Strong Crossover assimilates it to Condition C of the binding theory by making the following assumption:

(4) Traces / Copies left behind by A-bar movement are R-expressions. They cannot be bound.

1.2 No SCO with A-Movement

SCO is only found with A-bar movement.

(5) No SCO with A-movement:

a. *It seems to him$_i$ that David$_i$ is genius.

b. David$_i$ seems to himself$_i$ [t$_i$ to be a genius].

c. *It seems to him$_i$ that David$_i$'s wife is genius.

d. David$_i$'s wife seems to him$_i$ [t$_i$ to be a genius].

Traces / Copies left behind by A-movement in contrast are not R-expressions. They can be bound by c-commanding pronouns.

2 Weak Crossover

Weak Crossover: If a *wh*-chain and a pronoun are co-indexed, the tail of the *wh*-chain must c-command the pronoun.

(6) a. Who$_i$ t$_i$ loves his$_i$ mother?

b. *Who$_i$ does his$_i$ mother love t$_i$?
(* bad on the reading: Who is such that his mother loves him? *)
(compare with: Who$_i$ [t$_i$ is loved [by his$_i$ mother]]?)

c. [Which man]$_i$ did you say [t$_i$ dislikes [his$_i$ boss]]?

d. *[Which man]$_i$ did you say [[his$_i$ boss] dislikes t$_i$]?

(7) The WCO configuration: *Op$_i$ ... pron$_i$ ... x$_i$
(where pron$_i$ and x$_i$ do not c-command each other, Op$_i$ c-commands both)

An influential and attractive explanation of WCO comes in the form of Koopman and Sportiche (1983)'s Bijection Principle:

(8) There is a bijective correspondence between variable and A-bar positions i.e. each operator must A-bar exactly one variable and each variable must be bound by exactly one operator.

X A'-binds Y iff X is in an A-bar position, and X binds Y
(*who* A'-binds its trace in *Who$_i$ does Dawood like t$_i$?*)

X A-binds Y iff X is in an A-bar position, and X binds Y
(*Dawood* A-binds *his* in *Dawood likes his books*)

The Bijection Principle does not apply to A-binding. An A-binder can bind any number of variables:
[Every student]$_i$ told [his$_i$ friends] [that [his$_i$ siblings] disliked [his$_i$ cousins]].

2.1 WCO Configurations: the role of Linear Order

(7) is not stated in terms of linear order i.e. the pronoun does not have to be linearly in between the operator and the variable. Another version of the WCO constraint specifically invokes linear order:

(9) The Leftness Condition: *Op$_i$ ... pron$_i$ ... x$_i$
(where pron$_i$ and x$_i$ do not c-command each other, Op$_i$ c-commands both, and pron$_i$ precedes x$_i$.)

The Leftness Condition allows for the following cases which are ruled out by (7).

(10) a. Sructural crossover, but no overt crossover:
Op$_i$ [[.....x$_i$.....][.....pron$_i$.....]]

b. No Structural Crossover:
Op$_i$ [.....[[...x$_i$...].....pron$_i$.....]]

To see if the prediction made in (10a) is correct consider the following example:

(11) a. John [[told me [that Mona disliked her$_i$]] [because he was mad at Julie$_i$]].

b. John [[told me [that Mona disliked Julie$_i$]] [because he was mad at her$_i$]].

c. Which girl$_i$ did [John [[tell me [that Mona disliked t$_i$]] [because he was mad at her$_i$]]?

(7) $\rightarrow$ (11c) is ungrammatical.

(12) (from Lasnik and Stowell (1991):690)

a. Who$_i$ did [[you say [t$_i$ was a liar]] [before you met him$_i$]]?

b. Who$_i$ did [[Jan say [she admired t$_i$]] [in order to please him$_i$]]?

If (11c) and (12) are grammatical, then we have evidence in favor of the Leftness Condition and againt (7).

To test the prediction made in (10b) is trickier because extractions of the sort shown in (10b) are not permitted in English - they would constitute extraction out of a left branch, something that does not seem to be possible in English. We will return to this kind of example later.

2.2 Weakest Crossover

WCO effects are known to be weaker than SCO effects - hence the name. Further WCO effects seem to be even weaker / absent with some relative clauses unlike SCO effects.

(13) a. The student [who$_i$ [t$_i$ loves [her$_i$ mother]]] arrived this morning.

b. ( )The student [who$_i$ [[her$_i$ mother] loves t$_i$]] arrived this morning.

Compare with:

(14) a. No student [who$_i$ [t$_i$ loves [her$_i$ mother]]] arrived this morning.

b. ( )No student [who$_i$ [[her$_i$ mother] loves t$_i$]] arrived this morning.

It seems that not all A-bar movement environments trigger WCO:

(15) (from Lasnik and Stowell (1991):691, 698)

a. Tough Movement:
Who$_i$ t$_i$ will be easy for us [to get [his$_i$ mother] to talk to e$_i$]?

b. Parasitic Gaps:
Who$_i$ did you stay with t$_i$ [before [his$_i$ wife] had spoken to e$_i$]?

c. Topicalization:
This book$_i$, I expect [its$_i$ author] to buy e$_i$.

d. Appositive Relative Clauses:
This book$_i$, [which [[its$_i$ author] wrote t$_i$ last week]], is a hit.

Lasnik and Stowell (1991) argue that the nature of the operator in (15) differs from the operator in the cases where we find WCO effects, and argue that the WCO constraint should be formulated with this distinction in mind.

2.3 No WCO with A-Movement

WCO is not found with A-movement:

(16) a. Who$_i$ [t$_i$' seems [to his$_i$ mother] [t$_i$ to be intelligent]]?
(Can mean: Who is such that he seems to his mother to be intelligent?)

b. Every boy$_i$ seems to his$_i$ mother [t$_i$ to be intelligent].

(Note that the above chains involves both A and A-bar movement.)

3 Generalizing over SCO and WCO

Three Cases:

(17) SCO, ... indicates c-command:

a. Op$_i$.....x$_i$.....pron$_i$
→ binding possible (if not ruled out by Condn. B)

b. Op$_i$.....pron$_i$.....x$_i$
→ binding impossible

c. pron$_i$.....Op$_i$.....x$_i$
→ binding depends upon nature of Op$_i$

(18) a. Dave$_i$ thinks that [him$_i$, I admire t$_i$].

b. *Dave$_i$ wonders [who$_i$ I admire t$_i$].

The above contrast follows from the difference in meaning between *him* and *who*: *him* being a pronoun can be bound, while *who* being an interrogative expression cannot be bound.

(19) WCO, ... indicates absence of c-command

a. Op$_i$...[[..x$_i$..][...pron$_i$
→ binding should possible (but hard to test)

b. Op$_i$.....pron$_i$.....x$_i$
→ binding impossible

c. pron$_i$.....Op$_i$.....x$_i$
→ binding depends upon nature of Op$_i$, but pron$_i$ cannot directly bind Op$_i$

4 Crossover effects and Covert Movement

It has been noted that sentences with more than one quantifier phrase often display an ambiguity with respect to the scope of the quantifier phrases.

(20) Some student admires every senator.

a. some > every:
[some student]$_1$ [[every senator]$_2$ [t_1 admires t_2]]

b. every > some:
[every senator]$_2$ [[some student]$_1$ [t_1 admires t_2]]

This ambiguity is typically derived by the operation of Quantifier Raising (QR).

(21) Some student admires every senator. Some professor does, too.

a. ok: [some student > every senator], [some professor > every senator]

b. ok: [every senator > some student], [every senator > some professor]

c. not ok: [some student > every senator], [every senator > some professor]

d. not ok: [every senator > some student], [some professor > every senator]

Unlike instances of overt movement, QR tends to be finite-clause bound. Thus we generally do not find quantifiers interactions between quantifiers from two different clauses.

(22) Some student believes [that every senator is a crook].

a. ok: some > every

b. not ok: every > some

Given that QR involves movement, we might expect to find crossover effects and we do.

(23) SCO: *He$_i$ likes [every student]$_i$.

(24) WCO:

a. Every boy$_i$ likes his$_i$ mother.

b. *His$_i$ mother likes every boy$_i$.
(* bad on the reading that (a) had. *)

Once we apply QR, we are left with configurations that violate the SCO / WCO configurations respectively:

(25) SCO: [every student]$_i$ [he$_i$ likes t_i].

(26) WCO cases:

a. [Every boy]$_i$ [t_i likes his$_i$ mother].

b. *[Every boy]$_i$ [his$_i$ mother likes t_i].

c. Everyone$_i$ is implicated by [the fact [that he$_i$ owned a gun]].

d. *[The fact [that he$_i$ owned a gun]] implicates everone$_i$.

e. No man$_i$ should mistreat his$_i$ friends.

f. *His$_i$ friends should mistreat no man$_i$.

4.1 Variable Binding and Almost C-Command

The discussion of WCO / SCO involving covert movement of Quantificational Phrases (QP) can be recast as a discussion of when a given QP can bind a given pronoun.

From conditions on semantic interpretation, we know that at the level of semantic interpretation, a QP must c-command a pronoun that it binds. This accounts for the unambiguity of (27).

(27) [Every man]$_i$ loves [some painting in his$_i$ house].

a. ok: every man $>$ some painting in his house:
[every man]$_i$ [[some painting in his$_i$ house]$_k$ [t$_i$ loves t$_k$]]

b. not ok: some painting in his house $>$ every man:
[some painting in **his**$_i$ house]$_k$ [[every man]$_i$ [t$_i$ loves t$_k$]]
$\rightarrow$ *his* cannot be bound by *every man* under this structure.

But the conditions on variable binding do not just make reference to the level of semantic representation. They also make reference to the surface position of the QP and the pronoun.

(28) A QP can bind a pronoun iff it (almost) c-commands the pronoun in its surface position (i.e. before covert movement).

In all the good cases of variable binding by a QP that we have seen so far, the QP c-commands the pronoun it binds from its surface position. It does not do so in any of the cases where binding is ruled out.

This c-command requirement is something we have already seen in the context of anaphor binding. However, it turns out that variable binding requires something that is very close to c-command but not quite c-command. Some authors have called this notion 'almost c-command'.

(29) Possessors:

a. Possessors do not c-command object:

i. *[His$_i$ mother] loves himself$_i$.

ii. *[[Every boy]$_i$'s mother] loves himself$_i$.

iii. *[Whose$_i$ mother] loves himself$_i$?

b. But variable binding of object by possessor QPs is ok:

i. [[Every boy]$_i$'s mother] loves him$_i$.

ii. [[[Every boy]$_i$'s mother]'s sister] loves him$_i$.

iii. [[[[Every boy]$_i$'s mother]'s sister]'s doctor] loves him$_i$.

c. And variable binding of object by possessive *wh*-XPs is also ok:

i. [[Which boy]$_i$'s mother] loves him$_i$?

ii. [[[Which boy]$_i$'s mother]'s sister] loves him$_i$?

iii. [[[[Which boy]$_i$'s mother]'s sister]'s doctor] loves him$_i$?

(30) Inverse Linking:

a. [Someone from [every city]$_i$] despises it$_i$.

b. [Someone in [every city]$_i$] loves its$_i$ mayor.

The intuition expressed by several authors (see Ruys (2000) for an overview) is that the putative c-command requirement is satisfied for the QP 'by proxy' by the 'container' DP.

An alternative: we had noted earlier in our discussion of the Leftness Condition formulation of WCO that the formulation allowed for the following configuration:

(31) No Structural Crossover:
Op$_i$ [.....[[...x$_i$...].....pron$_i$.....]]

If we assume that at the level of semantic representation (call it LF, Logical Form), a QP must c-command a pronoun if it is to bind it, then the QP must move out of its 'container' DP and the problematic cases involving possessors and inverse linking can be seen as instances of the configuration in (31).

We seem to be left with a purely linear condition:

(32) A QP cannot bind a pronoun if it appears between the QP and its trace (i.e. if there is crossover).

4.2 Secondary Crossover Effects

Crossover Phenomena display a 'transitivity' effect. See Higginbotham (1980) and Postal (1993) for details.

(33) Secondary SCO:

a. *[Whose$_i$ sister]$_j$ does he$_i$ think [t$_j$ is intelligent]?

b. *[[Whose$_i$ sister]'s girlfriend]$_j$ does he$_i$ think [t$_j$ is intelligent]?

c. *[Whose$_i$ sister]$_j$ did they inform him$_i$ [that Joan would call t$_j$]?

d. *[[Whose$_i$ sister]'s girlfriend]$_j$ did they inform him$_i$ [that Joan would call t$_j$]?

(34) Secondary WCO:

a. ?? [His$_i$ father] loves [[every boy]$_i$'s mother].

b. ?? [Whose$_i$ mother]$_j$ does [[his$_i$ father] love t$_j$]?

These cases of secondary SCO / WCO can be shown to reduce to the regular SCO / WCO configurations if we assume that at the level of interpretation, everything but the Wh / Quantificational XP is in the base position:

(35) Secondary Crossover and Reconstruction:

a. SCO: *[Whose$_i$ sister]$_j$ does he$_i$ think [t$_j$ is intelligent]?
LF: Who$_i$ does [he$_i$ think [[t$_i$'s sister] is intelligent]]?

b. WCO: ?? [His$_i$ father] loves [[every boy]$_i$'s mother].
LF: [Every boy]$_i$ [[his$_i$ father] loves [t$_i$'s mother]]

4.3 Odds and Ends

4.3.1 Traces vs. Pronouns

- semantically bound pronouns and traces end up making very similar contributions.
- but Traces and not Pronouns are subject to SCO.

(36) a. * the person [who$_i$ [he$_i$ likes t$_i$]]
b. * the person [such$_i$ that [he$_i$ likes him$_i$]]
c. * the person [who$_i$ [he$_i$ thinks [Ann$_i$ likes t$_i$]]]
d. the person [who$_i$ [he$_i$ thinks [Ann$_i$ likes him$_i$]]]

4.4 WCO and Functional Readings of Questions

Questions with quantifiers often permit an answer that has been dubbed a 'functional answer' by Chierchia (1993).

(37) Who does every Englishman depend upon?
Answer: his mother

It has been noted that the functional reading is only available if the QP c-commands the trace of *wh*-movement:

(38) a. Who$_i$ does [[every Englishman] admire t$_i$]?
Ok: Functional Answer: his mother
Ok: Individual Answer: Prince William

b. Who$_i$ [t$_i$ admires [every Englishman]]?
Not Ok: Functional Answer: his mother
Ok: Individual Answer: Prince William

Giving a complex representation to the trace: $t^j{}_i$ - where the superscript must be bound by the QP allows us to relate the availability of functional readings to WCO.

References

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