Crossover

LING 252 · Ethan Poole · 11 May 2020

1 Types of crossover

- A central difference between A-movement and $\overline{\text{A}}$-movement concerns the ability to feed pronominal binding, known as CROSSOVER.

- ***The role of c–command***
  Binding of pronouns or reflexives is only possible (at least in most cases) if they are c–commanded by the binder:[1]

  (1) **Binder c–commands pronoun**

  a. [Every student]$_1$ thinks they$_1$ are lucky.

  b. [Every woman]$_1$ saw her$_1$ friends.

  c. [No corporation]$_1$ regrets that their$_1$ employees are underpaid.

  (2) **Binder does not c–command pronoun**

  a. *They$_1$ think [every student]$_1$ is lucky.

  b. *[Her$_1$ friends] saw [every woman]$_1$.

  c. *[Their$_1$ employees] regret that [no corporation]$_1$ is underpaid.

  (3) **Generalization**
  A quantificational expression Q may bind a pronoun P only if Q c–commands P.

[1] Ruys (2000) and Barker (2012) argue that in certain cases, binding is possible even in the absence of c–command. I will put these cases aside here.

⁕ ***Question***
How does movement interact with the generalization in (3)?

1.1 Strong crossover (SCO)

⁕ STRONG CROSSOVER results when an element is $\overline{\text{A}}$-moved over a c–commanding element that it is coindexed with. A-movement is not restricted in this way.

(4) **$\overline{\text{A}}$-movement**

a. *Who$_1$ did you say **he**$_1$ made you visit ___$_1$?

b. *Who$_1$ does **she**$_1$ like ___$_1$?

(5) **A-movement**
Mary$_1$ seemed to **herself**$_1$/***her**$_1$ [___$_1$ to be the best student in the class].

⇒ ***Problem***
It is not immediately clear why (4) should be ungrammatical, because it does in fact satisfy (3). In other words, what rules out the LF in (6)?

(6) Q_x [who$_x$ λ_1 [does she$_1$ like t_1]]

- ***The standard GB account***
  - The standard analysis of strong crossover is due to Chomsky (1981, 1982) and is formulated in terms of Binding Theory.
  - Chomsky (1981) defines "variable" in such a way that it includes the traces of $\overline{\text{A}}$-movement:

    (7) α is a VARIABLE iff
    a. α is an empty category,
    b. α is in an A-position, and
    c. α is locally $\overline{\text{A}}$-bound.

  - SCO is ruled out by treating "variables" as R-expressions, which are subject to Condition C:

    (8) Variables behave like R-expressions w.r.t. Binding Theory.

    (9) **Condition C**
    R-expressions must be globally A-free. [Chomsky 1981]

  - By contrast, a trace of A-movement is subject to Condition A:

    (10) Traces of A-movement behave as anaphors w.r.t. Binding Theory.

    (11) **Condition A**
    Anaphors must be locally A-bound. [Chomsky 1981]

  - Correspondingly, A-movement is not subject to SCO, as long as the crossed pronoun itself satisfies Binding Theory (that is, is an anaphor).

- ***What about copies?***
  This classical account crucially requires that different types of movement leave behind different types of traces. Unfortunately, this assumption can no longer be maintained once we move to the Copy Theory of Movement.

- ***Wholesale Late Merger***
  However, we can translate the account into a copy-theoretic framework by adopting Takahashi and Hulsey's (2009) Wholesale Late Merger (WLM) account of A-movement:

  (12) a. $\overline{\text{A}}$-movement must leave a full copy.[2]
  b. A-movement has the option of WLM. The base position contains only a D head, with the NP restrictor being late-merged into the landing site.

  (13) a. NP copies are subject to Condition C.
  b. D copies are not subject to Condition C.[3]

[2] Modulo adjuncts, irrelevant here.

[3] Perhaps this is because they are pronominal in nature.

1.2 Weak crossover (WCO)

⁎ WEAK CROSSOVER results when an element is $\overline{\text{A}}$-moved over an element that *contains* an element that is coindexed with it:

(14) a. *Who$_1$ does [**their**$_1$ boss] dislike ___$_1$?

b. *[Which employee]$_1$ did you say [**their**$_1$ boss] dislikes ___$_1$?

c. *the employee [$_{\text{RC}}$ who$_1$ [**their**$_1$ boss] fired ___$_1$]

- The name "weak" crossover is because the acceptability of WCO is judged to be better than that of SCO.
- Crucially, there is no general problem with *wh*-elements binding pronouns:

(15) a. **Who**$_1$ dislikes [**their**$_1$ boss]?

b. [**Which employee**]$_1$ said [**their**$_1$ boss] dislikes **them**$_1$?

c. the boss [$_{\text{RC}}$ **who**$_1$ fired [**their**$_1$ employee]]

- To summarize:

(16) **Generalization**
In a configuration where a pronoun P and a trace T are both bound by a quantifier Q, T must c–command P. [Lasnik and Stowell 1991]

- ***A-movement vs. $\overline{\text{A}}$-movement***
As with SCO, WCO seems to only restrict $\overline{\text{A}}$-movement. A-movement is fine in otherwise parallel configurations:

(17) a. **$\overline{\text{A}}$-movement**
*[Which student$_1$] did [**their**$_1$ advisor] meet ___$_1$?

b. **A-movement**
[Every student]$_1$ seemed to [**their**$_1$ advisor] [___$_1$ to be the smartest]

- ***The challenge of WCO***
Even if we ignore A-movement, WCO is tricky. The reason is that the trace/copy is not c–commanded by the pronoun, so appeals to the binding-theoretic properties of the trace/copy will not be successful. What, then, blocks LFs like (18)?

(18) Q_x [who$_x$ λ_1 [does their$_1$ boss dislike t_1]]

2 Syntactic accounts of WCO

- ***Syntactic vs. semantic approaches***
  There are many accounts of WCO. The original analyses were syntactic in nature—essentially constraints on operators and traces.[4]

- ***Crossover in Vata***
  Koopman and Sportiche (1983) present evidence from Vata that suggests that crossover is not restricted to empty elements (i.e. traces), but also obtains if movement leaves a resumptive pronoun:[5]

(19) **Resumptives in Vata**

a. àlɔ́ *(ɔ́) mlì là
who *(he) left wh
'who left'

b. yī ǹ gūgū nā *(ì) ɓlì là
what you think that *(it) fell wh
'what did you think happened'

(20) **WCO in Vata**

a. *àlɔ́$_1$ ɔ̀$_1$ nɔ́ gùgù nā ɔ̀$_1$ mlì là
who his mother think that he left wh
'who did his mother think left'

b. *àlɔ́$_1$ ǹ yrà ɔ$_1$ nɔ́ nā ɔ̀$_1$ mlì là
who you tell his mother that he left wh
'who did you tell his mother left'

- ***Bijection Principle***
  - Koopman and Sportiche (1983) conclude that an appropriately general account of WCO should not be limited to empty categories.
  - They propose a new definition of the term "variable" and postulate the Bijection Principle:

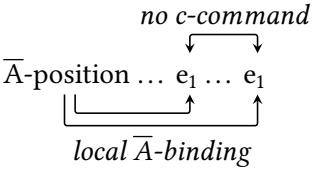
(21) α is a VARIABLE iff
  a. α is in an A-position, and
  b. α is locally $\overline{\text{A}}$-bound.

(22) **Bijection Principle**
There is a bijective correspondence between variables and $\overline{\text{A}}$-positions. (That is each operator must $\overline{\text{A}}$-bind exactly one variable, and each variable must be $\overline{\text{A}}$-bound by exactly one operator.) [Koopman and Sportiche 1983]

[4] For example, Koopman and Sportiche (1983) and Reinhart (1983).

[5] Resumptive pronouns carry low tone (ɔ̀, ì, …), whereas regular pronouns carry mid-high tone (ɔ́, í, …).

- ***Bijection and parasitic gaps***
  - One potential challenge to the Bijection Principle comes from parasitic gaps.
  - Koopman and Sportiche (1983) discuss ungrammatical parasitic-gap constructions like the following:

    (23) 

    (24) *Who$_1$ did you give [a picture of e_1] [to e_1]?
  - However, there are grammatical examples of parasitic gaps that seem to have the same relevant properties, and so the account would rule those out as well:

    (25) [Which paper$_1$] did Mary file e_1 [without reading e_1]?

- ***Another condition***
  Reinhart (1983) proposes that pronouns may only be bound from A-positions:[6]

  (26) A pronoun β may be interpreted as a variable bound by α only if α A-binds β.

[6] Note that this rule out both SCO and WCO.

3 A semantic account of WCO

- The two conditions above are purely syntactic in nature. More recently, accounts of WCO have been developed that attempt to deduce it from independently motivated properties of these constructions.
- Let us look at one influential analysis: the choice-function account of Sauerland (1998, 2004) and Ruys (2000).

3.1 Choice functions

- Reinhart (1997) proposes a revision to the standard Karttunen semantics of constituent questions. Her proposal only covers in-situ *wh*-phrases, but it can be extended to moved ones as well.
- ***Observation***
  In-situ *wh*-phrases can occur inside an island, but they can nonetheless be associated with *wh*-scope outside of that island:

  (27) a. Who reads [the books [that who writes]]?

  b. *Who do you read [the books [that ___ writes]]?
- ***Problem***
  This suggests that in-situ *wh*-phrases do not (obligatorily) undergo covert movement to [Spec, CP]. Reinhart (1997) concludes that this is indeed correct. However, this means that we now need a way of interpreting in-situ *wh*-phrases.

⁎ ***Reinhart's (1997) proposal***
In-situ *wh*-phrases are interpreted via *choice functions*.

- ***What are choice functions?***
  Choice functions are functions that take a set of individuals and return an individual within that set. They are hence of type $\langle\langle e, t\rangle, e\rangle$:

  (28) **Choice functions**
  Let f be a function from $D_{\langle e,t\rangle}$ to D_e. f is a CHOICE FUNCTION iff $f(A) \in A$ for every non-empty set A in the domain of f.

- Choice functions are independently used for cases where indefinites seem to take scope out of an island (Farkas 1981; Fodor and Sag 1982):

  (29) If a friend of mine from Texas had died in a fire, I would inherited a fortune.

- For example, a choice function analysis (30b) is truth-conditionally equivalent to (30c). Crucially, however, it achieves this without the need to move the restrictor out of an island:

  (30) a. Max will be offended if we invite some philosopher.

  b. $\exists x\,[(\textsc{invite}(x)(\text{we}) \wedge \textsc{philosopher}(x)) \rightarrow \textsc{will-be-offended}(\text{Max})]$
  $\longrightarrow$ too weak

  c. $\exists x\,[\textsc{philosopher}(x) \wedge (\textsc{invite}(x)(\text{we}) \rightarrow \textsc{will-be-offended}(\text{Max}))]$
  $\longrightarrow$ adequate, but would violate island

  d. $\exists f^{\text{CH}}\,[\textsc{invite}\,(f^{\text{CH}}(\textsc{philosopher}))\,(\text{we}) \rightarrow \textsc{will-be-offended}(\text{Max})]$
  $\longrightarrow$ adequate + no island violation

- ***Returning to questions***
  If in-situ *wh*-phrases are interpreted via unselective binding of choice functions, we get the correct interpretation without any island-violating movement:

  (31) a. Who will be offended if we invite which philosopher?

  b. $\lambda p\,.\,\exists x \exists f^{\text{CH}}\,[p = {}^\wedge(\textsc{invite}\,(f^{\text{CH}}(\textsc{philosopher}))\,(\textsc{we}) \rightarrow \textsc{will-be-offended}(x))]$

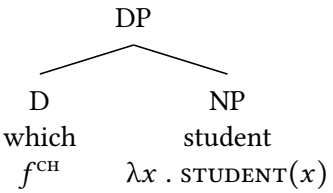
  c. For which x and f^{CH}, if we invite f^{CH}(philosopher), x will be offended?

3.2 Extending the choice function account

- Reinhart (1997) uses choice functions only to interpret in-situ *wh*-phrases.

- Sauerland (1998, 2004) and Ruys (2000) point out that there is no reason to not also treat moved *wh*-phrases in this way as well. All we need to say is that moved wh-phrases syntactically reconstruct their restrictor:

  (32)



(33) **Interpreting *wh*-movement**

a. The restrictor NP is not interpreted in the landing site.

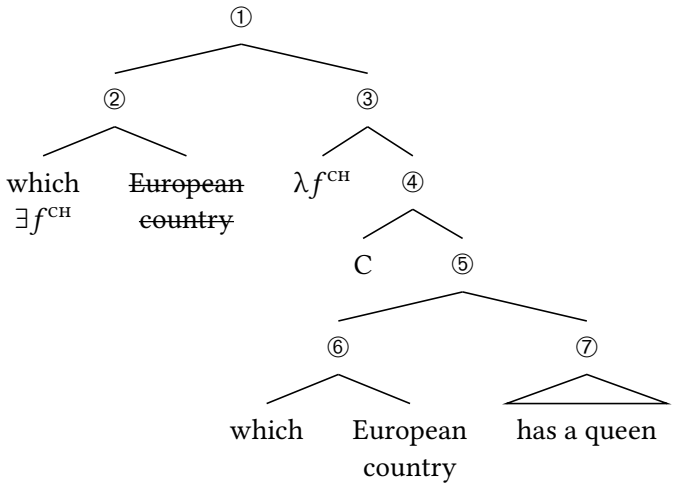
b. The D in the landing site is interpreted as an unselective binder of a choice function.

c. The D in the lower copy is interpreted as a choice function.

- ***Example***

(34) a. Which European country has a queen?

b.



c. $[\![⑦]\!] = \lambda x$. HAS-A-QUEEN(x)

d. $[\![⑥]\!] = f^{CH}\,(\lambda x$. EUROPEAN-COUNTRY$(x))$

e. $[\![⑤]\!] =$ HAS-A-QUEEN $(f^{CH}\,(\lambda x$. EUROPEAN-COUNTRY$(x)))$

f. $[\![C]\!] = \lambda q\,\lambda p$. $p = q$

g. $[\![④]\!] = \lambda p$. $p = {}^{\wedge}($HAS-A-QUEEN $(f^{CH}\,(\lambda x$. EUROPEAN-COUNTRY$(x))))$

h. $[\![①]\!] = \lambda p$. $\exists f^{CH}\,[p = {}^{\wedge}($HAS-A-QUEEN $(f^{CH}\,(\lambda x$. EUROPEAN-COUNTRY$(x))))]$

3.3 Back to WCO

- With all this in place, we have an account of crossover if all $\overline{\text{A}}$-movement involves abstraction over choice functions, and if A-movement involves abstraction over individuals (Sauerland 1998, 2004; Ruys 2000).[7]

(35) a. A-movement involves abstraction over individual variables.

b. $\overline{\text{A}}$-movement involves abstraction over choice-function variables.

- ***$\overline{\text{A}}$-movement and WCO***
  If $\overline{\text{A}}$-movement involves abstraction over choice functions, it will never be able to result in binding of a pronoun simply because the two do not have the same semantic type. The unavailability of binding is what underlies WCO:

(36) a. *Who$_1$ does [their$_1$ boss] dislike ___$_1$?

b. λp . $\exists f^{CH}\,[p = {}^{\wedge}($DISLIKE $(x$'S BOSS$)\,(f^{CH}\,($PERSON$)))]$

[7] We also need assume that pronouns can only be of type *e*, or more accurately, that they cannot range over choice functions.

- ***A-movement and WCO***
  A-movement, on the other hand, involves binding of type e variables and can hence result in pronominal binding:

  (37) a. [Every student]$_1$ seemed to [their$_1$ advisor] [___$_1$ to be the smartest]

  b. $\forall x \left[\textsc{student}(x) \rightarrow \textsc{seemed}\left(x\text{'s }\textsc{advisor}\right) = x \textsc{ is the smartest}\right]$

- The account also captures cases where *wh*-elements can bind pronouns:

  (38) a. [Which boy]$_1$ [___$_1$ likes [his$_1$ mother]]?

  b. $\lambda p \,.\, \exists f^{\textsc{ch}} \left[[\lambda x \,.\, x \text{ likes } x\text{'s mother}](f^{\textsc{ch}}\,(\lambda y \,.\, \textsc{boy}(y)))\right]$

3.4 Choice functions and QR

- One movement type that seems to match the expectations generated by a choice function account quite well is QR.[8]

[8] Ruys (2000)

- First, QR extends scope:

  (39) Some cat loves every child.

  a. $\exists \gg \forall$: [some cat$_1$ [every child$_2$ [___$_1$ loves ___$_2$]]]

  b. $\forall \gg \exists$: [every child$_2$ [some cat loves ___$_2$]]

- Second, QR does not feed pronominal binding:

  (40) *[Its$_1$ owner] likes [every cat]$_1$

- Third, QR does not allow for Condition C obviation, even with adjuncts:

  (41) *He$_1$ liked [the story that Alex$_1$ wrote].

- All three properties would follow on a choice function analysis:

  (42) $\forall f_2 \exists f_1 \left[\textsc{loves}\left(f_1\,(\lambda x \,.\, \textsc{cat}(x))\right)\left(f_2\,(\lambda y \,.\, \textsc{child}(y))\right)\right]$

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