

A Global Economy Analysis of Weak Crossover

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0. Introduction

Chomsky (1992:48) proposes the following economy condition:¹

[...] given two convergent derivations D_1 and D_2 with the same LF output, both minimal and containing the same number of steps, D_1 blocks D_2 if its links are shorter.

Reinhart (1993a,b), developing work by Golan (1993), argues that this condition, the "shortest link" condition, should be relativized to interpretation. This relativization does not apply to all economy effects, such as the "skipped landing-position" condition or other economy conditions (cf. Chomsky 1992:(9))², but just to "global economy" effects, which involve a violation of the shortest link condition. The proper formulation of global economy of this type should state that one convergent derivation blocks another, if it has shorter links, and results in an interpretively equivalent LF representation. Derivations resulting in non-equivalent LFs are not compared, hence cannot block each other.

Superiority, as in (1), is an example of a shortest link violation:

- (1) a who t said what
b *what did who say t

(1b) is blocked, because it competes with the alternative derivation (1a), which involves a shorter movement: subject-preposing instead of object-preposing. Since (1a) and (1b) are interpretively equivalent (although their LFs may not be identical, depending on the exact treatment of *Wh*-in-situ), (1b) is ruled out. The relevance of interpretation can be seen in (2).

¹ I have benefitted from comments by Elena Anagnostopoulou, Johan Kerstens, Ad Neeleman and Tanya Reinhart, as well as members of the TIN-audience and an anonymous LIN-reviewer.

² This is obvious from an example such as (i), which is ruled out by the "skipped landing-position condition" without there being any alternative derivation:

- (i) *how do you wonder [why John said [Peter left t t]]

- (2) a $\text{who}_i t_i$ wonders what_j [who_k said t_j]
 b $\text{who}_i t_i$ wonders who_k what_j [t_k said t_j]
 c who_k $\text{who}_i t_i$ wonders what_j [t_k said t_j]

In (2a), again an object has been preposed leaving a subject in situ. Now note, that (2a) might in principle be mapped onto two different LFs, whose different interpretations are represented here as (2b) and (2c). The interpretation (2b), however, is not available. This can be attributed to superiority. In order to obtain the interpretation (2b), a shorter derivation might have been chosen, in which the embedded subject is preposed and the complement is left in situ:

- (2) d $\text{who}_i t_i$ wonders who_k [t_k said what_j]

(2a) is not, however, ruled out entirely, because it can be assigned the interpretation in (2c). The LF that gives this reading is not blocked, because it is not equivalent to the shorter derivation (2d). In (2c) the embedded subject is given matrix scope. Since there is no shorter derivation yielding this reading, (2a) with interpretation (2c) is allowed.

In the following sections, I shall apply this approach to WCO effects, showing that it obviates the need to formulate any syntactic condition on pronominal binding, such as the Bijection Principle, at all. WCO will be seen to follow from a failure to apply a more economical derivation that would have resulted in an equivalent LF. We will show that this analysis provides an elegant solution to a range of long-standing problems in the description of pronominal variable binding (PRO-gates, "transitivity"-examples), as well as to the Argument-Adjunct asymmetry noted by Stowell (to appear) and the Weakest Crossover cases discussed by Lasnik & Stowell (1991).

1. Standard WCO effects

Consider the standard WCO violation in (3):

- (3) * who_i does his_i mother love t_i

Most analyses of WCO employ some version of the following generalization: (3) is ruled out, because pronouns coindexed with operators must be A-bound, and may not be A-bar bound (e.g. Reinhart (1983), Koopman & Sportiche's (1982) Bijection Principle). It is well known that this generalization fails to account for the well-formedness of examples like (4), which were noted by Higginbotham (1980) (called "transitivity" examples in Ruys 1992), where the pronoun is licensed but not A-bound:

- (4) whose_i mother t loves him_i

The analysis to be proposed here, on the other hand, makes crucial use of the existence of (4). I propose that (3) is ruled out, because a shorter derivation would have been possible resulting in an equivalent LF-representation. For instead of (3), we could have derived (4). (3) results in LF (5a), and (4) is associated with LF (5b) (after reconstruction).

- (5) a which person x_i , his_i mother loves x_i
 b which person x_i , x_i 's mother loves him_i

The LFs in (5) are interpretively equivalent. In fact, if we assume that Abar bound pronouns count as variables at LF (following Chomsky (1982), Koopman & Sportiche (1982)), (5a) and (5b) are identical. Thus, by economy, if one results from a shorter derivation than another, the latter will be ruled out. This is in fact the case: (4) is derived by a case of subject-movement, whereas (3) involves a movement from object position. Therefore, (3) is ruled out, in fact as a superiority (shortest link) violation.

The same reasoning applies to (6).

- (6) a *his_i mother loves every boy_i
 b every boy's_i mother loves him_i

(6a) is ruled out, because it competes with and is blocked by (6b), which involves a shorter case of QR.

Consider now the full range of transitivity cases:

- (7) a whose_i mother t loves him_i
 b every boy's_i mother loves him_i
 c [which picture of which man_i] t pleases him_i
 d [someone in every city_i] hates it_i

The present analysis provides a straightforward treatment: binding is allowed because the alternative derivation with the operator in the place of the pronoun would not have been shorter. In the case of (7a,b,c) this is unproblematic; the proper treatment of (7d) requires a well-developed view of the internal structure of DP (hence the length of a derivation extracting *every city* from the subject); I will not enter into this here.³

³ Since our analysis implies that the ill-formedness of e.g. (3) is *due to* the well-formedness of the more economical (4), we expect (3) to be well-formed in languages in which (4) and other "transitivity" examples are ill-formed. Higginbotham (1980) suggests Mandarin Chinese may be such

In sum, the generalization governing pronominal binding now turns out to be, not that a pronoun must be A-bound if it is to be interpreted as a bound variable, but that a bound pronoun may not be contained in an XP that is superior to the coindexed operator. But we shall see that this generalization is only correct in so far as it follows from the explanation in terms of economy proposed here.

Consider some immediate consequences. It has been noted before, that an operator may sometimes move across a coindexed pronoun in apparent violation of WCO conditions. The PRO-gate examples discussed in section 3 below are among these potential counterexamples; another is cited in (8) (attributed to Ross by Reinhart 1983):

- (8) [that people hate him_i] disturbs every president_i

When QR preposes the QNP in (8), it crosses the pronoun and ends up locally A-bar binding both its trace and the pronoun, in violation of the Bijection Principle. Nevertheless, the example is well-formed. Now note that no shorter LF-equivalent derivation is possible:

- (9) *[that people hate every president_i] disturbs him_i

Placing the QNP in the place of the pronoun and vice versa does not result in a shorter derivation because for the QNP to bind the pronoun from this position it has to be extracted from the subject, yielding a Sentential Subject Constraint violation.

While (8) may still be somewhat substandard, we can now easily improve it by making extraction from the position of the pronoun more difficult. Thus, (10) is not blocked because its only possible competitor would yield a CNPC violation:⁴

a language. However, in this language (3) and (6a) may well be out for independent reasons: QR does not allow the object to take scope over the subject in Chinese (cf. Aoun & Li 1989), and possibly, if Chomsky (1992) or Reinhart (1993b) are correct, *Wh*-raising also does not front (the entire DP of) *Wh*-in-situ. German may be a relevant example; for unexplained reasons, the transitivity case (4) is ill-formed in this language, and, as we expect, there is no WCO in the German counterpart of (3). Palauan (cf. Georgopoulos 1991) may be relevant for different reasons: this language combines an absence of WCO effects with an absence of other subject - object asymmetries.

⁴ We do find such ill-formed examples as (i). However, we may assume that (i) is blocked by (ii), which allows the QNP to take wide scope in spite of the CNPC (hence presumably without extraction) (cf. Cooper 1979). See Ruys (in prep a) for a possible analysis.

- (i) *[the woman that he_i loves most] loves every man_i least
(ii) [the woman that every man_i loves most] loves him_i least

- (10) I wonder who_i the fact that his_i mother loved him_i prevented t_i from committing murder

More generally, it is noted in the literature that WCO violations tend to improve when the pronoun is further embedded. The contrast in (11) is a case in point:

- (11) a *which man_i did you give [a picture of t_i] to him_i
 b which man_i did you tell [a sister of t_i] that we hated him_i

So far, this observation has remained unexplained; but taking the view of WCO developed here, it is as expected, and we can now proceed to refine our treatment of these cases by developing a more accurate characterization of economy.

Our analysis of WCO now has the following general properties. We expect bound variable anaphora to be ruled out just in case we can construct an equivalent alternative which involves a shorter movement. We can usually attempt to construct such an alternative by placing the (trace of the) operator in the position of the pronoun, and vice versa. Two classes of predictions follow: we expect bound variable anaphora to be exceptionally allowed in case, for some reason, no alternative derivation is available at all, and in case the alternative derivation turns out to be interpretively non-equivalent. An example of the first class is given in section 2; an example of the second in section 3.

2. Argument-Adjunct asymmetries

Turning now to an example that presents a problem to nearly all previous accounts of WCO, consider (12).

- (12) a which book_i did you file t_i [without PRO reading it_i]
 b which book_i did you_j tell John to file t_i [without PRO_j reading it_i]

(12a) is well-formed, in spite of the fact that it violates most existing WCO conditions. Note, that the trace of *which book* does not c-command, hence does not A-bind the pronoun. This is supported by the fact that parasitic gaps, which obey an anti-c-command requirement, can be licensed in this context. In any case, there can be no doubt that the pronoun fails to be A-bound in (12b), which is equally well-formed. Hence, these examples violate the Bijection Principle and other WCO statements. Stowell (to appear) concludes that WCO shows an argument - adjunct asymmetry: only pronouns contained in arguments cause WCO violations.

Our present analysis predicts this state of affairs. The derivations in (12) are allowed because they are not blocked by any shorter derivations. This is so, because the only alternative derivations with equivalent LFs would involve

placing the (trace of the) *Wh*-phrase in the place of the pronoun, and vice versa. But this would not result in a well-formed derivation at all, because *Wh*-movement would violate the Adjunct Condition. Hence the ill-formedness of (13), the only conceivable competitors for (12).

- (13) a *which book did you file it [without PRO reading t]
 b *which book did you tell John to file it [without PRO reading t]

Note, that the ill-formedness of (13) is not due to WCO, but merely to a disallowed *Wh*-movement: replacing *it* with *this document* does not improve these examples. Thus, the argument - adjunct asymmetry found in WCO is reduced to the argument - adjunct asymmetry known from the CED.

3. *PRO-gates*

Among the most recalcitrant WCO-exceptions are the following, called *PRO-gate* examples by Higginbotham (1983).

- (14) a who_i did [PRO_i devotion to his_{*i*} country] inspire t_i
 b [PRO_i devotion to his_{*i*} country] inspires every soldier_{*i*}

In neither case are either the *PRO*-subject or the overt pronoun A-bound, hence a WCO (Bijection Principle) violation should be expected to occur. Higginbotham exempted *PRO* from his Accessibility Condition (and allowed *PRO* to license the pronoun); Safir (1984) accounts for these exceptions by limiting the BP prohibition to cases where the pronoun is overt.⁵

Again, from our present point of view, there is no problem here. Recall, that a derivation can only be blocked by a shorter derivation which has an equivalent LF (whose LF is interpreted equivalently). The examples in (14) do not have alternative LF-equivalent derivations. Such competitors would have to be derived by extracting the *Wh*-phrase or QNP either from the position of *PRO*, or from the position of the pronoun.

⁵ Some examples roughly similar to (14) but *without* the *PRO* are also well-formed; on first inspection, this appears to coincide nicely with the absence of a shorter alternative:

- (i) a *the queen's devotion to his_{*i*} country inspires every soldier_{*i*}
 b the queen's devotion to every soldier's_{*i*} country inspires him_{*i*}
 (ii) a the teacher's writing to his_{*i*} father annoyed every boy in the class_{*i*}
 b *the teacher's writing to every boy (in the class)'s_{*i*} father annoyed him_{*i*}

The latter option will not work, since this will not result in an acceptable derivation at all. If the operator is placed in the position of the overt pronoun, then it (or its trace) will be A-bound by PRO, resulting in a Strong Crossover (condition C) violation. The structure in (15) illustrates this.

- (15) * $[\text{PRO}_i \text{ devotion to every soldier's}_i \text{ country}]$ inspires him_i

In (15), the relevant alternative to (14b), *every soldier* is bound by PRO. The relevant alternative to (14a) would have *whose* in the place of *his*, triggering pied-piping, and equally violating SCO.

The other possible way of constructing an alternative to the examples in (14) would involve replacing the PRO with the operator. This would result in well-formed derivations, but not in ones that are LF-equivalent. The results would be the LFs (16) (after reconstruction).

- (16) a which person x_i [x_i 's devotion to his_i country] inspired him_i
 b every soldier x_i [x_i 's devotion to his_i country] inspires him_i

Now note that where (the LFs of) the examples in (14) have PRO as a specifier in the subject NP, the examples underlying (16) have an operator. This fact causes the LFs to be non-equivalent, because they have distinct interpretations. An NP with a PRO-specifier is an indefinite (weak) NP; an NP with an operator as a specifier is definite (strong).

The definiteness contrast is exemplified in (17):

- (17) a there was PRO devotion to his country in every soldier's eyes
 b *there was every soldier's devotion to his country in his eyes
 c *who believed that there was whose devotion to his country in his eyes
 d *there was his devotion to his country in John's eyes

Whereas an existential sentence allows the presence of an NP with a PRO-specifier in (17a), replacing PRO with an operator or an overt pronoun causes a Definiteness Restriction violation in (17b,c,d).

Of course, it is not necessary to construct a *there*-insertion context to determine that an NP with a PRO specifier is indefinite; interpretation suffices:

- (18) a PRO devotion to his own country was gleaming in John's eyes
 b PRO devotion to each other's countries inspired Stalin and Churchill
 c every soldier's backpack was searched for proscribed literature
 d every child's walking stick was (then) cut to size with a chainsaw

The subjects in (18a,b) are interpreted as indefinites; neither presupposes that any devotion exists; both can be used without any previous mention of the devotion in

question (Novelty condition). (18c), on the other hand, presupposes that every soldier has a backpack; (18d) illustrates the Familiarity condition on definites in that it is felicitously used only if it has been previously determined that every child has a walking stick.

In general, we can say that any DP specified by a DP in the genitive is definite (Cf. Woisetschlaeger 1983), and any DP specified with PRO is indefinite. Although explaining this restriction falls outside the scope of this paper, we might suppose a strict parallel between the DP system and the IP system, as follows. If a [+finite] Tense checks (assigns) only Nominative case, and [-finite] Tense checks only Null case, we might equally suppose that [+definite] D checks Genitive, and [-definite] D checks Null case.

I conclude, that the alternative derivations with the operator replacing PRO cannot block (14), because this replacement changes the definiteness of the subject NPs, hence their semantics, so that the resulting LFs cannot be considered equivalent. In this, the PRO-gate examples differ minimally from regular WCO-violations (such as (3), or (6a)), where the subject is specified by *his*, hence is definite. In sum, the PRO-gate examples in (14) have no more economical competitors, and are consequently ruled in.

4. Weakest Crossover

In Lasnik & Stowell (1991) it was pointed out that some operators systematically fail to generate WCO violations. These are the "semantically empty" operators (either overt or Null) that appear in Parasitic Gap, *easy*, *too* and Topicalization constructions, and in Appositive relative clauses:

- (19) a who_i did you stay with t_i [OP_i before his_i wife had spoken to t_i]
 b who_i t_i will be easy for us [OP_i to get his_i mother to talk to t_i]
 c most books $_i$ are too obscene [OP_i to have their $_i$ authors publish t_i]
 d this book $_i$, OP_i I expect its $_i$ author to buy t_i
 e Gerald, who_i his_i mother loves t_i , is a nice guy

Lasnik & Stowell attribute the well-formedness of the examples in (19), which appear to violate the Bijection Principle, to the supposed exceptional properties of traces left by the movement of semantically Null operators, which are exempted from the WCO condition. Ruys (in prep a) argues instead that a pronoun may be variable-bound iff it can be written in the scope of its operator (through being c-commanded from an A-position); this implies that the pronouns in (19) may be variable-bound by the external expressions that strongly bind the Null operators. See Ruys (in prep b) for an implementation of this view in an economy framework. Alternatively, we might say (Reinhart, p.c.) that the correct condition on

bound anaphora is not that a pronoun must not be locally A-bar bound, but that it must be A-bound (locally or not).

A global economy approach to variable binding allows of the following analysis. The pronouns in (19a) through (19d) may be bound by the Null operators, because a shorter derivation is not available. For some reason that need not concern us for our analytic purposes, Null operators do not trigger pied piping. This implies that a Null operator cannot be in a specifier position, because movement would then violate the Left Branch Constraint. The examples in (20) confirm this diagnosis:

- (20) a *who_i did you stay with t_i [OP_i before t_i wife had spoken to John]
 a' **who_i did you stay with t_i [[OP_i wife]_j before t_j had spoken to John]
 b *who_i t_i will be easy for us [OP_i to get t_i mother to talk to John]
 c *most books_i are too obscure [OP_i to have t_i authors publish anything]
 d *this book_i, OP_i I expect t_i author to leave the country

(20) involves no cases of bound variable pronouns: ill-formedness is due solely to conditions on the distribution of Null operators. Since shorter alternatives with this structure are not available, the Weakest Crossover structures in (19a-d) are allowed.⁶

This analysis faces one potential problem: (19e) should not allow variable binding because a shorter derivation is in fact available:

- (21) Gerald, whose_i mother loves him_i, is a nice guy

We have to assume, then, that (19e) is not a case of variable binding, but that the pronoun is merely coreferential with *Gerald*. This cannot easily be tested as Quantificational NPs and *Wh*-expressions do not take Appositive Relative clauses, and these do not appear to allow of a sloppy identity test (restricted relatives do show a WCO effect for many speakers, as expected). See Ruys (in prep a) for a different view.

⁶ The text assumption that topicalization involves Null-operator movement, instead of adjunction to IP of the topic itself (Lasnik & Saito 1992), is not crucial to the analysis. If we assume instead that in (19d) *this book* itself has moved, there is still no more economical alternative. We cannot place *this book* in the position of *its* and extract it from there, because that would violate the Left Branch Constraint. We can place *this book* in the position of *its* and topicalize the entire NP, yielding (i).

(i) this book's author, I expect t to buy it

This gives us a shorter and well-formed alternative, but not one that is interpretively equivalent; here, *this book's author* is interpreted as the topic, not *this book* (there is no "pied piping" with topicalization, with only part of the preposed material being interpreted as the topic).

5. Further Research

In order to implement a notion of "global economy" such as that employed above, the following is required. We need to define an equivalence relation over derivations, that groups convergent derivations into equivalence classes. Global economy then states that a derivation is allowed unless the equivalence class it belongs to contains a shorter derivation. Let us call the equivalence relation required for "shortest link"-type economy CMP: derivation D is allowed if no $D' \in [D]_{\text{CMP}}$ has shorter links. We can now go about defining this relation in various ways.

In a previous framework we might have chosen to CMPare only derivations with identical D-Structures; in the minimalist framework, which does not have the notion of D-Structure, a similar statement would not be impossible, but less easily formulable. Chomsky's formulation of the shortest link condition cited in the introduction supposes that two derivations are CMParable if their LFs are identical. The approach adopted by Golan and Reinhart diverges slightly from Chomsky's position: two derivations are CMParable if their LFs are interpretively equivalent, not necessarily identical. This is more promising, since it clearly rates (1a) and (1b) as equivalent under CMP, hence allows (1a) to block (1b) (repeated):

- (1) a who t said what
 b *what did who say t

Note, that if *Wh*-raising does not obtain, as suggested by Chomsky (1992) and Reinhart (1993a,b), then the LFs of (1) will not be identical, hence the shortest link condition cannot exclude (1b) under Chomsky's formulation. And even if *Wh*-raising does obtain, this may well result in non-identical adjunction structures. Hence, it seems advisable to employ a less straightforward equivalence relation CMP than "identity of LF".⁷

Interpretive equivalence, on the other hand, as an alternative is not as yet a well-defined notion. We might attempt to go so far as to equate CMP with logical equivalence of interpretations, but this is certainly not clear beforehand. Consider (22):

- (22) a which book _{i} did you file t_i [OP _{i} without reading e_i]
 b which book _{i} did you file t_i [without reading it_i]

The parasitic gap construction in (22a) is well-formed, despite the fact that it is presumably logically equivalent to (22b), which does not involve a case of Null

⁷ In fact, Chomsky's formulation would appear to render the condition virtually vacuous: if two derivations have identical LFs, their links will likely have identical lengths.

operator movement, hence is a shorter derivation. Clearly, we do not want CMP to hold between (22a) and (22b). The desired distinction follows from Chomsky's formulation. CMP only relates derivations that contain the same number of steps, and (22a) contains more steps than (22b). (Obviously, other refinements of CMP, for instance in terms of the number of maximal chains at LF, are also possible.)

But while this solution takes (22) to show that logical equivalence is too weak a condition on CMP-equivalence, (23) suggests that it may be too strong:

- (23) a who did you introduce t to whom [OP without talking to e]
 b *whom did you introduce who to t [OP without talking to e]

We want (23a) to block (23b) as an equivalent but longer derivation (superiority). But (23a,b) are not interpretively equivalent, since only the moved *Wh*-element ends up binding the parasitic gap. In order to explain both (22) and (23), we might say that strong binding (chain composition) is in some sense invisible to CMP. Alternatively, we might provide for (23) by saying that the shorter derivation (23a) allows of both readings at LF, the inability of *Wh*-in-situ to license parasitic gaps being a post-LF phenomenon invisible to CMP.

In our discussion of WCO examples above we have relied on a fairly straightforward notion of interpretive equivalence that will presumably fit many alternative formulations of CMP. Examples such as (22) and (23), however, show that refinement may not a trivial matter. It is clear that global economy developed along these general lines entails the empirical question which derivations are to be considered equivalent⁸. Also, a well-worked out definition of the length of a step is required, in terms of c-command, perhaps in terms of domains as proposed in Chomsky (1992) for slightly different purposes, or possibly in terms of Paths. Future research should address these questions.

⁸ Note, that our present, uncomplicated view of global economy assumes that LFs are disambiguated for binding by placement of indices as in (5). Without indices (3) and (4) are not equivalent in that both are ambiguous between a referential (deictic) reading for the pronoun and a bound-variable reading. But the 'deictic' reading for (3) is not equivalent to the 'deictic' reading for (4), hence the LFs, if left ambiguous, will not be interpretively equivalent. Leaving LFs ambiguous in this manner may therefore lead us to the following view of global economy: an interpretation LF' of an LF₁ with derivation D₁ is allowed unless LF' could have been arrived at from LF₂ with D₂, D₂ shorter than D₁. This would move us from economy of derivation to economy of interpretation: we are now not comparing equivalent derivations, but equivalent semantic representations. This is in fact closer to Reinhart's and Golan's position. Note, that (2a) may then be left ambiguous at LF, economy of interpretation preempting the reading paraphrased in (2b) in view of the interpretation of (2d). This view would also imply that (1b) is not ruled out by the grammar. It will not, however, be assigned any interpretations, because its only possible interpretation can be arrived at through (1a).

6. Conclusion

In this paper I have argued that both regular WCO examples and a wide range of traditional problems in the field of bound variable anaphora can be shown to follow automatically from a notion of economy of derivation in terms of shortest movement relativized to equivalent LFs as proposed in recent work by Reinhart and Golan.

If this view is correct, Weak Crossover turns out not to be a unified phenomenon requiring a unified account in terms of a specialized rule or mechanism, but an epiphenomenon that results from the interplay of independent mechanisms: economy, conditions on extraction, Piep Piping, even definiteness (perhaps Case checking inside DP) etc. The success of this analysis can be taken as evidence for the view of economy adopted here. But for our proposal to be well-defined, much more work is clearly required.

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