

Binding, Focus, Extraction*

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1 A puzzle about pronoun binding

1.1 Background - pronoun binding 101

- (1) a. **Every/no female student** submitted **her** paper. *her*: ✓ referential, ✓ bound
b. **Only/Even Ann** submitted **her** paper. *her*: ✓ referential, ✓ bound

- I will call cases like (1a) under the bound variable interpretation *regular binding*, and cases like (1b) under the bound interpretation *focus binding*.

1.2 Extraction in regular binding still allows a bound reading

- In regular binding, it is famously possible to get a bound reading even if the pronoun is extracted outside the surface scope of its associated quantifier, e.g. (2a).

- (2) a. Which of **her**₁ papers did **every/no female student**₁ submit? (✓ bound pronoun)
b. *what is the function $f_{(e,e)}$ from female students to their papers such that every/no x submitted $f(x)$?*

- Semantically speaking, as the paraphrase in (2b) reveals, these are instances of *functional readings* (Jacobson, 1994; Engdahl, 1986; Heim, 2012, a.o.). Both the pronoun and the argument of the relevant function are bound by the DP quantifier.

1.3 ... But extraction in focus binding doesn't!

- We observe that no bound interpretation is permitted when the same extraction manipulation is performed on the focus binding construction in (1b), i.e. in the case of *only*:

- (3) a. # Which of **her**₁ papers did [only Ann]₁ submit? (✗ bound pronoun)
b. **what is the function $f_{(e,e)}$ from individuals to their papers s.t. no x other than Ann submitted $f(x)$?*

- To see this, consider the scenario in (4) which naturally supports a functional reading of the questions below it.

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- (4) Context: Ann, Betty and Carla are grad students in linguistics. Last year they were each required to write 3 (individual) papers - one in phonology, one in syntax and one in semantics. They were encouraged by the department to submit any of their papers to conferences. Ann was very confident in herself, so she submitted all her three papers. Betty submitted her phonology and syntax papers, but not her semantics; and Carla submitted only her phonology paper.

Table 1: Papers and Conferences

Student	Paper	submit to a conference?
Ann	phonology	✓
	syntax	✓
	semantics	✓
Betty	phonology	✓
	syntax	✓
	semantics	✗
Carla	phonology	✓
	syntax	✗
	semantics	✗

- (5) Which of her papers did every female student submit to a conference?
-Her phonology paper.
- (6) # Which of her papers did only Ann submit to a conference?
* -Her semantics paper (= *the target of the bound interpretation, see paraphrase in (3)*)
- The only possible interpretation for the question in (6) is one where the pronoun is referential. Since this meaning clashes with world knowledge (normally people can't submit other people's papers to conferences), the question sounds weird.
 - *wh*-questions are not the only extraction construction that manifests the phenomenon:
- (7) **Pronoun extraction in regular binding:**
- Bill asked which of **her**₁ papers **every girl**₁ submitted to a conference. (*wh*-question)
 - Her**₁ phonology paper - **every girl**₁ submitted to a conference. (Topicalization)
 - The paper of **hers**₁ that **every girl**₁ submitted was in phonology. (Relative Clause)
 - It is **her**₁ phonology paper that **every girl**₁ submitted. (Cleft)
- (8) **Pronoun extraction in focus binding** (# marks that the pronoun can only be referential):
- # Bill asked which of **her**₁ papers **only Ann**₁ submitted to a conference. (*wh*-question)
 - # **Her**₁ phonology paper - **only Ann**₁ submitted to a conference. (Topicalization)
 - # The paper of **hers**₁ that **only Ann**₁ submitted was in phonology. (Relative Clause)
 - # It is **her**₁ phonology paper that **only Ann**₁ submitted. (Cleft)

Empirical Generalization (first version): A pronoun bound by a DP associating with *only* cannot be extracted out of the c-command domain of *only*/the DP.

- The empirical picture with *even* isn't as clear as it is with *only*. For some speakers *even* behaves exactly like *only*, although others find it possible to get the bound interpretation for an extracted pronoun in (9).
- (9) Additional context: Compared to the all other students in class, Carla is very unconfident of herself. She rarely ever submits her papers to conferences, and we learned not to expect her to. But to our surprise it turns out that specifically this year, there was one topic she did submit her paper in, and we want to find out which one it is.
- a. ? Which of **her** papers did **even Carla** submit to a conference?
 - b. ? the paper of **hers** that **even Carla** submitted to a conference was her phonology paper.
 - c. ? It is **her** phonology paper that **even Carla** submitted to a conference.
- But even those who accept the bound reading of (9) don't get it in (10).
- (10) a. Context: I'm talking about my male friends and the girls they dated in highschool.
The woman he dated in highschool - every friend of mine ended up marrying. (✓ bound)
- b. Further context: Billy really had a bad relationship with his girlfriend in highschool. No one expected him to end up marrying her.
 # *The woman he dated in highschool - even Billy ended up marrying.* (✗ bound)
- I tentatively conclude that *even* behaves like *only*, and that further investigation is required to understand the governing factors behind some people's intuition in (9).
 - Furthermore, I will take it as a working hypothesis that the empirical generalization extends to all cases of focus sensitive operators (though I haven't investigated other focus sensitive expressions beyond *even* and *only*).

Empirical Generalization (final): A pronoun bound by a DP associating with a focus sensitive *O* operator cannot be extracted out of the c-command domain of *O*/the DP.

- However, from hereon all my examples of focus binding will be with *only*.

1.4 *Only* does not block reconstruction across the board

- One might try to argue that the reason for the diverging behavior between regular and focus binding is that in order for a extracted pronoun to be interpreted as bound it must reconstruct at LF to its base position (Heim, 2012, e.g.), and that for some unknown reason such reconstruction is blocked across *only DP*.
 - This explanation would face difficulties in light of (11) below, which shows that pronoun reconstruction is still available as long as the binder is not *only DP* itself.
- (11) Context: Bill wants every female student₁ to submit her₁ phonology paper; John wants every female student₁ to submit her₁ phonology and syntax paper.
- a. Which of her₁ papers does only John want every female student₁ to submit to a conference?
 (✓ bound interpretation)

2 What's going on? A preliminary proposal

- I suggest that what the contrast in extraction patterns between (7) and (8) teaches us is that:
 - (i) Focus binding is represented in the grammar differently from regular binding (syntactically and/or semantically); and
 - (ii) There is some restriction imposed only on the representation of focus binding which explains the impossibility of bound interpretation in (8).
- I will propose a way to make sense of (i), following the framework of focus interpretation developed in Kratzer (1991).
- Ideally, given a suitable story for (i), (ii) should follow from the semantics alone (e.g. from what we know about the interpretation of movement chains and maybe of functional readings).
- Unfortunately, my attempts to develop a (purely) semantic story of this kind have not been too fruitful so far.
- I will thus lay out a "PFy" account for (ii), which doesn't do a lot more than encoding the facts.

2.1 The idea in a nutshell

- Binding in focus constructions is represented obligatorily by **F-coindexation**.
- There's a restriction on F-coindexation that effectively says that two F-coindexed elements cannot be pronounced (if they are pronounced) in different Focus Domains.
- In a little more detail...

2.2 Focus Binding as F-coindexation

- Kratzer (1991) develops and motivates a theory of focus interpretation which, instead of keeping track of alternative propositions in the familiar way (Rooth, 1992), keeps tracks of special variable assignments which assign denotation to distinguished F-variables. The mechanism:
 - Focused-marked constituents bear an indexed F_i variable.
 - Every constituent receives two denotations: its regular one and another one relative to a special focus-variable assignment, h .
 - h only looks at F-indices, and maps them to denotations.
 - Different h 's map the same F-variable to different alternative denotations.
 - Focus sensitive operators quantify over different (contextually supplied) h 's.
- A sketch of the semantic rules (from Schwarzschild 1999; see appendix for more detailed version):

(12) If α is F-marked, then

- a. $\llbracket \alpha_{F_i} \rrbracket^{g,h} = h(F_i)$
- b. $\llbracket \alpha_{F_i} \rrbracket^g = \llbracket \alpha \rrbracket^g$

(13) If α has no F-marking, then

- a. $\llbracket \alpha \rrbracket^{g,h} = \llbracket \alpha \rrbracket^g$ if α is not complex.
- b. if α has components $\beta_1 \dots \beta_n$, then $\llbracket \alpha \rrbracket^{g,h}$ is the result of applying the semantic rule for α to $\llbracket \beta_1 \rrbracket^{g,h} \dots \llbracket \beta_n \rrbracket^{g,h}$

- As Beaver and Clark (2008) note, this framework is suitable for encoding binding dependencies in focus constructions.
- The idea is that Focus binding can simply be encoded as **F-coindexation**.
- As a sketch, consider the possible LF representation in (14a) for *only Ann submitted her phonology paper* and the rough denotations of the prejacent of *only* in (14b) and of the whole sentence in (15):

- (14) a. Only [β Ann_{Fi} submitted her_{Fi} phonology paper]
 b. $\llbracket \beta \rrbracket^g = \text{Ann submitted Ann's phonology paper}$
 $\llbracket \beta \rrbracket^{g,h} = h(Fi) \text{ submitted } h(Fi)\text{'s phonology paper}$
- (15) $\llbracket (14a) \rrbracket^g = \text{Ann submitted Ann's phonology paper} \wedge$
 $\neg h_1(Fi) \text{ submitted } h_1(Fi)\text{'s phonology paper} \wedge$
 $\neg h_2(Fi) \text{ submitted } h_2(Fi)\text{'s phonology paper} \wedge$
 ...
 $= \text{Ann submitted Ann's phonology paper} \wedge$
 $\neg \text{Betty submitted Betty's phonology paper} \wedge$
 $\neg \text{Carla submitted Carla's phonology paper} \wedge$
 ...
 (Assuming that $h_1(Fi) = \textit{betty}$ and $h_2(Fi) = \textit{carla}$).

- I propose that F-coindexation is **required** as the means to achieve binding in focus constructions; i.e., it is not possible to just employ “normal” coindexation and abstraction¹.
- To motivate this requirement, I adopt a version of Heim (2008) *Feature Transmission Rule*:

- (16) Feature Transmission Under Variable Binding: If α binds β (i.e. if β is c-commanded by α 's trace), features on α must be copied onto β .

- If F-indices are features on F-marked constituents, (16) then makes sure that F-features are obligatorily transferred to a bound pronoun.

- (17) a. **Base generation**:
 $\text{only}_C [\sim C \text{ Ann}_{1,F_2} \text{ submitted her}_{1,F_2} \text{ phonology paper}]$
 b. **Binding**:
 $\text{only}_C [\sim C \text{ Ann}_{F_2} \lambda 1 t_1 \text{ submitted her}_{1,F_2} \text{ phonology paper}]$
 c. **Obligatory F-feature Transmission**:
 $\text{only}_C [\sim C \text{ Ann}_{F_2} \lambda 1 t_1 \text{ submitted her}_{1,F_2} \text{ phonology paper}]$

- The appendix verifies that (17c)'s interpretation is essentially what's shown in (15).
- So the representation of Focus binding is necessarily different from regular binding.

¹ There's a question that I will leave here for future inquiry, namely what needs to be said about the mapping between Focus marking and prosody in a system that makes use of F-variables. In the sentence (14a), for instance, the pronoun doesn't show any signs of being stressed. For now, I stipulate that two F-coindexed constituents that stand in C-command relation are associated with one and the same stress).

(i) F-indexing rule: If two or more constituents are F-coindexed and one c-commands the other, only the higher one gets assigned stress.

It is worth noting that the question of the syntax-prosody mapping also is general to other systems that make use of F-variables, e.g. Kratzer (1991); Erlewine (2014).

2.3 A PF constraint on F-coindexed elements

- Finally, I stipulate the following:

(18) **PF constraint on F-coindexed elements:** F-coindexed constituents must be pronounced in the c-command domain of the Focus-sensitive operator that associates with them².

- (18) does the crucial work in deriving the core empirical generalization I'm concerned with.
- It prevents a bound interpretation In (3), for instance, because in order for binding to take place the pronoun must (by hypothesis) be F-coindexed with its binder, but the pronoun isn't pronounced in the c-command of it's associating *only*, violating (18).
- This is admittedly a stipulation, and must be derived from more basic principles.
- In closing, however, I would like to point out that the system predicts that even in focus binding constructions, an extracted pronoun *can* be interpreted as bound **as long as both the pronoun and its binder are both pronounced in the c-command domain of their associating operator**. This prediction is borne out:

(19) I only know which of her₁ papers ANN₁ submitted (✓ pronoun bound)

²This presupposes a suitable definition of what it means for a focus-sensitive operator to "associate" with a constituent. Here I assume that an operator *O* associates with F-marked constituents $\{A, B, \dots\}$ if *O* c-commands $\{A, B, \dots\}$ and there is no closer focus sensitive operator *O'* that c-commands them (i.e. no other focus sensitive operators can "intervene", in the sense of Beck 2006). More work is needed to determine if this is doesn't over/undergenerate.

References

- Beaver, D. I. and B. Clark (2008). *Sense and Sensitivity: How Focus Determines Meaning*. Wiley-Blackwell.
- Beck, S. (2006). Intervention effects follow from focus interpretation. *Natural Language Semantics* 14(1), 1–56.
- Engdahl, E. (1986). *Constituent Questions: the syntax and semantics of questions with special reference to Swedish*. Dordrecht: D. Reidel.
- Erlewine, M. Y. (2014). *Movement out of focus*. Ph. D. thesis, Massachusetts Institute of Technology.
- Heim, I. (2008). Features on bound pronouns. *Phi theory: Phi-features across modules and interfaces*, 35–56.
- Heim, I. (2012). Functional readings without type-shifted noun phrases. ms.
- Jacobson, P. (1994). Binding connectivity in copular sentences. In *proceedings of SALT 4*.
- Kratzer, A. (1991). The representation of focus. In A. von Stechow and D. Wunderlich (Eds.), *Semantik: Ein internationales Handbuch der zeit-genössischen Forschung*, pp. 825–834. Walter de Gruyter.
- Rooth, M. (1992). A theory of focus interpretation. *Natural language semantics* 1(1), 75–116.
- Schwarzschild, R. (1999). Givenness, avoidf and other constraints on the placement of accent. *Natural language semantics* 7(2), 141–177.

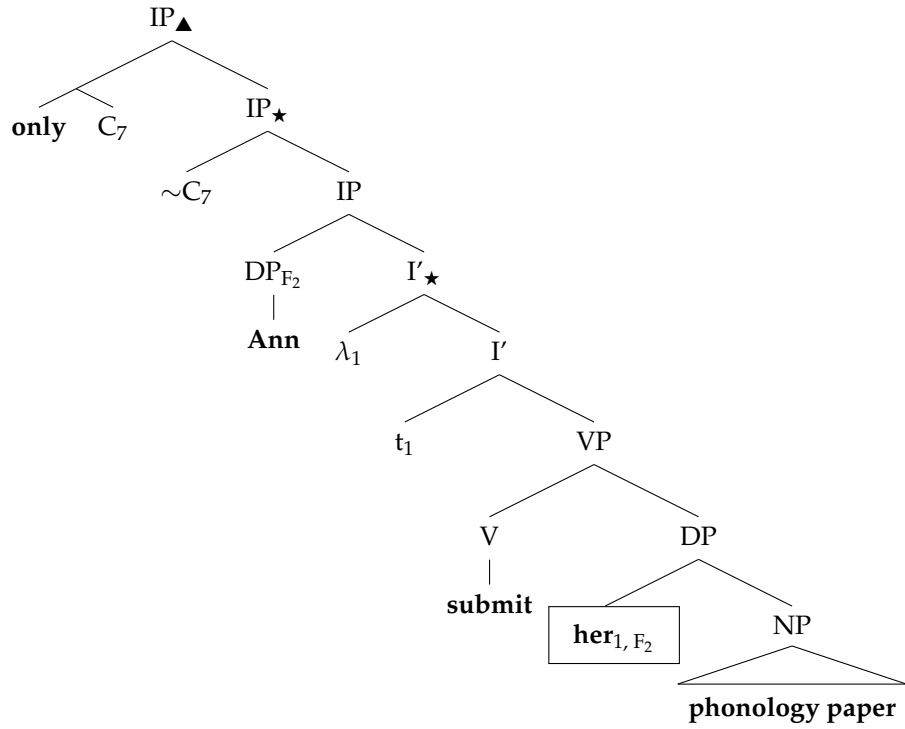
Appendix: Illustration of the Semantics

- (20) If α is F-marked, then
- $\llbracket \alpha_{F_i} \rrbracket^{g,h} = h(F_i)$
 - $\llbracket \alpha_{F_i} \rrbracket^g = \llbracket \alpha \rrbracket^g$
- (21) If α has no F-marking, then
- if α is not complex, $\llbracket \alpha \rrbracket^{g,h} = \llbracket \alpha \rrbracket^g$
 - Functional Application:** If $\alpha = [\beta \gamma]$ and $\llbracket \beta \rrbracket^g$ is a function whose domain includes $\llbracket \gamma \rrbracket^g$, then
 - $\llbracket \alpha \rrbracket^g = \llbracket \beta \rrbracket^g(\llbracket \gamma \rrbracket^g)$
 - $\llbracket \alpha \rrbracket^{g,h} = \llbracket \beta \rrbracket^{g,h}(\llbracket \gamma \rrbracket^{g,h})$
 - Predicate Abstraction:** If $\alpha = [\lambda_i \beta]$, then
 - $\llbracket \alpha \rrbracket^g = \lambda x. \llbracket \beta \rrbracket^{g[x/i]}$
 - $\llbracket \alpha \rrbracket^{g,h} = \lambda x. \llbracket \beta \rrbracket^{g[x/i],h}$
- (22) **Squiggle:** If $\alpha = [\sim C_i \beta]$, then:
- $\llbracket \alpha \rrbracket^g$ is only defined if $g(C_i) \subseteq \{ \llbracket \beta \rrbracket^{g,h'} : h' \text{ is a (total) Focus-variable assignment} \}$ and $\llbracket \beta \rrbracket^{g,h_0} \in g(C_i)$ ³
 - If defined, then
 - $\llbracket \alpha \rrbracket^g = \llbracket \beta \rrbracket^g$
 - $\llbracket \alpha \rrbracket^{g,h} = \llbracket \alpha \rrbracket^g$
- (23) $\llbracket \text{only} \rrbracket^g = \lambda C. \lambda p : p = 1. \forall q \in C [p \hat{\neq} q \hat{\rightarrow} q = 0]$

³Convention: h_0 is the focus-variable assignment which “ignores” F-marking, i.e. $\llbracket X \rrbracket^{g,h_0} = \llbracket X \rrbracket^g$ for every X .

2.4 Derivation

(24)



- (25)
- $\llbracket \mathbf{her}_{1, F_2} \rrbracket^g = g(1)$
 $\llbracket \mathbf{her}_{1, F_2} \rrbracket^{g,h} = h(F_2)$
 - $\llbracket \mathbf{I}' \rrbracket^g = g(1)$ submitted $g(1)$'s phonology paper
 $\llbracket \mathbf{I}' \rrbracket^{g,h} = g(1)$ submitted $h(F_2)$'s phonology paper
 - $\llbracket \mathbf{I}'_{★} \rrbracket^g = \lambda x. x$ submitted x 's phonology paper
 $\llbracket \mathbf{I}'_{★} \rrbracket^{g,h} = \lambda x. x$ submitted $h(F_2)$'s phonology paper
 - $\llbracket \mathbf{IP} \rrbracket^g = \text{Ann}$ submitted Ann's phonology paper
 $\llbracket \mathbf{IP} \rrbracket^{g,h} = h(F_2)$ submitted $h(F_2)$'s phonology paper
 - $\llbracket \mathbf{IP}_{★} \rrbracket^g$ is only defined if
 $g(C_7) \subseteq \{h(F_2) \text{ submitted } h(F_2)\text{'s phonology paper: } h \text{ is a Focus-variable assignment}\}$.
 If defined, $\llbracket \mathbf{IP}_{★} \rrbracket^g = \text{Ann submitted Ann's phonology paper}$.
 $\llbracket \mathbf{IP}_{★} \rrbracket^{g,h} = \llbracket \mathbf{IP}_{★} \rrbracket^g = \text{Ann submitted Ann's phonology paper}$
 - $\llbracket \mathbf{IP}_{▲} \rrbracket^g$ is only defined if:
 - $g(C_7) \subseteq \{h'(F_2) \text{ submitted } h(F_2)\text{'s phonology paper: } h' \text{ is a Focus-variable assignment}\}$
 - Ann submitted Ann's phonology paper.
 If defined, $\llbracket \mathbf{IP}_{▲} \rrbracket^g = 1$ iff $\forall q \in C[\text{that Ann submitted Ann's phonology paper} \nRightarrow q \hat{\ } \rightarrow q = 0]$
 iff \neg Betty submitted Betty's phonology paper
 \neg Carla submitted Carla's phonology paper
 $\neg \dots$

3 Aftermath

3.1 Interesting observations from Roger

1. It looks like when there's no overt pronoun, functional (or is it "functional"?) readings are possible:

- (Context: talking about the soldiers in the army battalion, who are required to leave their gun somewhere safe inside **their** house. It turned out that John was unique in his choice of where to store his gun...)

In which room did only John leave his gun over the weekend?

I'm not sure though that this has to be a functional reading, and not some kind of "kind" reading (which is absent in the case of overt pronoun because intuitively speaking there is no natural sense in which "NP of his" can be turned into a kind. Need to be worked out).

2.