Binding and ellipsis: is a traditional theory still viable?

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This incorporates some corrections to (31) and (32), which were not stated correctly in the original handout, and other minor changes.

1. Introduction

Prior to Reinhart (1983), a significant body of work on binding (and its interaction with ellipsis) was characterized by two hypotheses:[1]

> **Hypothesis I:**
> The binding conditions regulate a "coreference" (or coindexation) relation
> which subsumes all anaphoric relations.

> **Hypothesis II:**
> VP ellipsis is constrained by a strict parallelism requirement (syntactic identity or semantic equivalence.).

Although hypotheses I-II are simple and intuitively quite plausible, they are currently rather unpopular. This is largely due to the influence of a research program initiated by Reinhart (1983). In Reinhart's view, the binding constraints regulate only true semantic binding. The illusion that coreference is also subject to these constraints derives from a preference for binding over coreference

Heim (2007) has recently attempted to revive a more traditional formulation of the binding theory:

> Tanya Reinhart pioneered and developed a new and very influential approach to the syntax and semantics of anaphora...The central innovation concerned the architecture of the theory. The labor traditionally assigned to Binding Theory was broken up into two very different modules. One component (the "real" Binding Theory, if you will) regulates only one type of anaphoric relation, namely variable binding in the sense of logic. A new and different mechanism, variously thought of as a pragmatic principle, an economy constraint, and an interface rule, takes care of regulating other semantic relations, particularly coreference. The latter mechanism

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[1] See e.g. Lasnik 1976, Sag 1976, Williams 1977.

crucially involves the construction and comparison of alternative Logical Forms and their meanings. I would like to reexamine the line of reasoning that has led to this bi-modular architecture. I will suggest that the problems it was meant to solve could have been addressed in a different way.

This talk will attempt to revise and extend Heim's proposals to present a new take on the traditional binding theory consistent with hypotheses I and II. This attempt is partly motivated by an interest in the status of a third, Un-Cartesian hypothesis:

>**Hypothesis U:** The binding conditions should be stateable over grammatical structures without reference to model-theoretic semantic notions.

My primary aim in this talk is to make a case for Hypotheses I and II. However, I would also like to suggest that if these hypotheses can be successfully defended, this lends some support to Hypothesis U (though I and II together by no means entail U, or vice versa).

1.1. Conclusions to be drawn

- Most of the remaining problems with Heim's (2007) proposal can be solved while maintaining hypotheses I and II. In particular, Dahl's paradigm (Dahl 1973,1974) can be accounted for without abandoning strict parallelism, or making use of economy conditions such as Rule H.

- There is a "semantic hump" in the theory of binding and ellipsis. That is, it seems to be impossible to avoid defining a constraint *somewhere* which smoothes over the distinction between binding and coreference. Reinhart pushed down the hump in the core binding theory, but it popped up again in the theory of ellipsis. In defence of hypothesis II, I will hope to show that we can push down the hump in the theory of ellipsis. But predictably enough, the hump will then pop up once again in the binding constraints themselves.

- With regard to Hypothesis U, the challenge for an Un-Cartesian linguist is to find a way of getting rid of this hump altogether, rather than just shifting it around.

1.2. Outline

- The empirical case for and against Reinhart's bi-modular architecture and Rule I.

- Evaluation of Heim's (2007) proposal for a return to a traditional binding theory.

- An attempt to supplement Heim's theory with an analysis of Dahl's paradigm.

2. Rule I: for and against

The key proposal of Reinhart (1983), later developed as Rule I by Grodzinsky & Reinhart (1993:88), is a prohibition on the use of coreference when binding could be used instead:

(1)   Rule I: Intrasentential Coreference
        NP A cannot corefer with NP B if replacing A with C, C a variable A-bound by B,
        yields an indistinguishable interpretation.

There are two important consequences of (1). First, it accounts for the Condition C effect in
(2a). Second, it blocks the use of coreference in (2b), so that (2b) can be blocked by a
formulation of Condition B which regulates only binding relations:

(2)   a. * He_1 thinks that $John_1$ is intelligent.
        b. * $John_1$ likes him_1.

How strong are the arguments in favor of Rule I, and are there any serious problems with it?

- Reinhart's primary arguments in favor of Rule I are theoretical. Rule I offers an
  elegant and explanatory analysis of Condition C effects, and gets rid of the vague and
  mysterious notion of "coreference" which was key to earlier formulations of the
  binding theory.[2]

- The empirical arguments in favor of Rule I are relatively weak.

- Rule I faces significant empirical problems.

2.1. Empirical arguments in favor of Rule I

2.1.1. Condition B/C obviation effects

Reinhart (1983) presents (what can be anachronistically reinterpreted as) arguments in favor
of Rule I based on data such as the following from Evans (1980):

(3)   a. Everyone has finally realized that Oscar is incompetent. Even he has realized that
           Oscar is incompetent.
        b. I know what Bill and Mary have in common. Mary adores Bill, and Bill adores him
           too.

We will consider Heim's (2007) response to these empirical argument later on. Here I would
like to note a more general response made in Chomsky 1981:227fn45:

> Superficially, there appears to be [evidence that r-expressions need not be free]: it is
> possible to contrive contexts in which such structures as [*John said that John would
> win*] are acceptable. But it is not clear that such contexts provide counter-evidence to
> principle (C), despite appearances. The reason is that there appears to be a general
> discourse principle of the rough form (iii), with corollary (iv):
>
> (iii)   Avoid repetition of R-expressions, except when conditions warrant.

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[2] The GB binding theory is not explicitly formulated in terms of coreference, but as Howard Lasnik has pointed
out, something must be said to ensure that, e.g., "$John_1$ likes him_2" cannot be interpreted with *him* referring to
John.

(iv)   When conditions warrant, repeat.

Suppose that some general discourse condition of the form (iii), hence (iv), accounts for the contexts that permit [*John said that John would win*]. Then these contexts do not constitute counterevidence to principle (C); rather, they indicate that principle (C) may be overridden by some condition on discourse, not a very startling fact.

To put it another way, we could just replace Rule I with a condition such as (4):[3]

(4)   Modified Rule I:
        Conditions B/C may be violated if replacing the offending pronoun/r-expression with a reflexive/pronoun does not allow the original interpretation.

Although (4) is not as principled as Reinhart's (1983) Gricean pragmatic analysis, it seems no more stipulative than Rule I.

2.1.2. Evidence from child language

Grodzinsky & Reinhart (1993) present evidence from child language acquisition for Rule I. They note that children are able to detect Condition C violations with quantificational antecedents before they can do so with referential antecedents. This would be expected if the detecting the latter required the use of Rule I, which is plausibly taken to be computationally costly.

It is at present an open question whether children do in fact perform better with quantificational antecedents, and if Rule I is the best explanation of this fact if they do (Conroy et. al. 2009, Elbourne 2005, Grolla 2005).

2.2. The issue of local vs. global evaluation

As Reinhart (2006) notes, the absence of a Condition B obviation effect in (5) seems to suggest that Rule I must be evaluated locally (i.e. conjunct-by-conjunct):[4]

(5)   John$_1$ likes him$_1$ and Bill does [like him$_1$] too.

If Rule I were evaluated globally, then the use of coreference rather than binding in the first conjunct would be justified, since it yields a different interpretation for the sentence as a whole than that which would be obtained if *him* were bound by *John* as a variable.

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[3] (4) is no doubt a bit rough around the edges, and may face one or two empirical difficulties which Rule I does not. For example (although this is a somewhat controversial issue within binding theory in itself), one might argue that Condition B effects are still found in configurations where no dedicated reflexive form is available. Romance obviation effects are one possible case. (The *We like me* examples in section 2.4 are another, but these are problematic for Rule I too.)

[4] Fox (2000) assumes local evaluation of Rule H for similar reasons.

On the other hand, if Rule I is evaluated locally, it seems that strict readings should never be available! One must always use binding in the first conjunct, and given a strict parallelism constraint, this forces a sloppy reading.

> Implicit in Reinhart (1983) is a strong challenge to the parallelism constraint on VP ellipsis. If it is true that binding (rather than coreference) *must* be used in a simple sentence such as (6), then there can be no strict parallelism constraint on VP ellipsis:
>
> (6)   John thinks that he is intelligent.
>
> The question of whether or not coreference is available in (6) therefore has far-reaching consequences. Rule I makes it possible to get rid of Condition C, and state Condition B as a pure constraint on binding, but it forces a rejecti of the strict parallelism requirement.

2.3. Condition C effects in configurations where binding is impossible

Montalbetti (1984) notes that overt subject pronouns in Spanish, in contrast to null subjects, cannot be interpreted as bound variables:

(6)	* Nadie$_1$	cree	que	él$_1$	es	inteligente.
	No-one	believes	that	he	is	intelligent.

However, overt subject pronouns can take referential antecedents — (7a) — and if the pronoun and its antecedent swap positions, a Condition C violation is induced — (7b):

(7)	a. Juan$_1$	cree	que	él	es	inteligente.
	John	believes	that	he	is	intelligent.
	b. * Él$_1$	cree	que	Juan$_1$	es	inteligente.
	He	believes	that	John	is	intelligent.

This is somewhat unexpected given Reinhart's analysis of Condition C effects. If binding is impossible in (7a), as (6) suggests, then the relation between *Juan* and *el* in (7a) is presumably coreference. But then, if coreference is licit in (7a), why not in (7b)? Or to put it another way, if Rule I blocks (7b) (because replacing *Juan* with a variable bound by *él* would yield the same interpretation), then why doesn't Rule I also block (7a) (since replacing *él* with a variable bound by *Juan* would yield the same interpretation)?

2.4. *We like me*

Lasnik (1991) notes that examples such as (8a-b) pose a problem for Rule I:[5]

(8)   a. * We$_{\{1,2\}}$ like me$_1$.
        b. * They$_{\{1,2\}}$ like him$_1$.
        c. * He$_1$ thinks that the boys$_{\{1,2\}}$ are intelligent.

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[5] This is an anachronistic interpretation of Lasnik (1991). Lasnik is criticizing the pragmatic analysis of Reinhart (1983) rather than Rule I of Grodzinsky & Reinhart (1993), but the criticism carries over.

In (8a), for example, replacing *me* with a variable bound by *we* would clearly not yield an indistinguishable interpretation, and yet overlapping reference seems to trigger a Condition B effect. The same logic applies in (8b-c).

We also have examples such as (9)-(10):

(9)   * [Each of the boys$_1$]$_2$ likes them$_1$.

(10)   * [Each of them$_1$]$_2$ said that the boys$_1$ are intelligent.

The coreference relations between *the boys* and *them* in (9)-(10) presumably cannot violate Rule I, since these pairs do not stand in a c-command configuration (there is no binding alternative). It seems that Conditions B/C themselves must block the relation between (the variable bound by) *each* and *them*/*the boys* in (9)-(10). But then, Conditions B/C must be formulated in such a way that they are sensitive to covaluation (or "overlapping valuation") relations between bound variables and referential expressions. If so, Rule I seems superfluous.

2.5. Epithets

Lasnik (1976, 1991) notes that epithets in English appear to be subject to Condition C in the same way as ordinary r-expressions.

(11)   a. John$_1$ thinks that he$_1$ is intelligent.
          b. * He$_1$ thinks that John$_1$ is intelligent.
          c. * The idiot$_1$ thinks that John$_1$ is intelligent.
          d. * John$_1$ thinks that the idiot$_1$ is intelligent.

He points out that Rule I cannot obviously account for the deviance of (11d-e), since there is no binding alternative which yields the same interpretation. (12), for example, presumably does not have the same interpretation as (11c-d):

(12)   John$_1$ thinks that he$_1$ is intelligent.

Schlenker (2005) has argued that Lasnik is mistaken in diagnosing (11d-e) as Condition C violations. Rather, he proposes that (11d-e) violate an "antilogophoricity" constraint on the interpretation of epithets (Dubinsky & Hamilton 1998). The complement of *think* is evaluated from the perspective of the matrix subject, and "An epithet must not be anteceded by an individual from whose perspective the attributive content of the epithet is evaluated." However, it is not clear that antilogophoricity accounts for examples such as (13):

(13)   * Bill$_1$ said to John$_2$ that the idiot$_{*1/*2}$ had done it wrong again.

The embedded clause presumably cannot be evaluated from both Bill's and John's perspectives.

> The empirical arguments in favor of Rule I are fairly weak, and it faces some significant empirical problems.
>
> (However, this section has not discussed the use of Rule-I like conditions in the analysis of local anaphoric binding. For example, Reuland (2001), Safir (2004), argue that the use of local anaphoric binding is in some sense preferred to the use of variable binding when it yields the same interpretation. I will not attempt to evaluate such analyses in this talk.)

3. Heim (2007)

Heim first notes that there is no great difficulty in defining a notion of "covaluation" which subsumes binding and coreference:

(14)   Let α and β be occurrences of DPs of type e in an LF φ, and let C be a subject context. Then β is covalued with α in φ and C iff for all $\langle w,g \rangle \in$ C and all $g' \supseteq g$, $[\![\varphi]\!]^{w,g'} = [\![\varphi^{\alpha/\beta}]\!]^{w,g'}$, where $\varphi^{\alpha/\beta}$ is the result of replacing β by a copy of α in φ.

   ("The idea is simple. A DP is covalued with another one if you could have repeated this other one in its place and still said the same thing.")

This suffices to show that we can make precise the naïve notion of "coreference" which traditional binding theory relied on.

3.1. Condition B and C obviation cases

Heim points out, correctly I think, that data of the kind considered in section 2.1.1, together with further problematic examples such as (15)-(16), do not provide strong evidence in support of Rule I (or in the case of (16), Rule H):

(15) He_1 must be $John_1$, because he_1's wearing $John_1$'s coat.

(16)   Every $senator_1$ is worried that only HE_1 voted for him_1.

(15) is handled by Postal's (1970) distinction between presupposed and asserted coreference. (16) is not a Condition B violation simply because *HE* does not c-command *him*, owing to the presence of *only*.

3.2. No account of Dahl's paradigm

Heim acknowledges that her theory has little to say regarding the Dahl paradigm. This is not obviously a problem for Heim's approach, since Fox's Rule H (and Roelofsen's FVE) could probably be added on to Heim's theory without too much difficulty. (On my understanding, neither Fox nor Roelofsen make any assumptions regarding the format of LFs which are incompatible with Heim's.) However, Roelofsen has shown that Rule H faces significant empirical problems, and FVE requires the rejection of hypothesis II.

3.3. Covaluation as a semantic notion

As is clear from (14), Heim's theory relies on a semantic definition of covaluation. In the second part of her paper, Heim attempts to restrict possible patterns of indexation in such a way that the binding constraints can be stated purely formally in terms of co-indexation rather than coreference. The results are mixed. I will return to this issue in the conclusion.

> From the present point of view, the key problem for Heim's theory (if one is persuaded that examples such as (15)-(16) can be set aside) is it's failure to provide an account of Dahl's paradigm compatible with hypotheses I and II.

4. Dahl's paradigm

Both Fox (2000) and Reinhart (2006) take the missing reading in Dahl's paradigm to ruled out by the same constraint that is responsible for strong crossover. This line of analysis is challenged by Roelofsen (2008), who argues that two separate conditions are needed (FVE for Dahl and Movement Economy for SCO. The latter is a version of Rule H restricted to movement, similar to the global Shortest Move constraint of early Minimalism.)

I will argue that once we get our background assumptions in order, a very simple formulation of a Strong Crossover constraint (or Condition C) suffices to account for the Dahl paradigm. Fox and Reinhart make use of two rather intricate constraints (Rule H and Rule I respectively) which are stated in terms of interpretatively equivalent comparison derivations. But the reasons for stating the constraints in this fashion have nothing to do with the Dahl paradigm itself. Rather, they have to do with some of the problems considered in the preceding section (e.g. exceptional co-binding).

> I will now argue that Fox and Reinhart are correct that the Dahl effect is a strong crossover effect. A simple formulation of the crossover constraint suffices; there is no need to make use of an economy condition.

4.1. Some backround: Dahl's paradigm and Fox (2000)

Dahl (1973,1974) observes that the interpretation of the elided VP in (17) is restricted in a surprising way. When both pronouns in the first conjunct are anteceded by John, the pronouns in the elided VP may receive either strict or sloppy readings. However, as shown in (18), the second pronoun may receive a sloppy reading only if the first does also:

(17)   John knows that he loves his mother and Bill does too.

(18)   John knows that John loves John's mother and
        a. …Bill knows that Bill loves Bill's mother.
        b. …Bill knows that John loves John's mother.
        c. …Bill knows that Bill loves John's mother.
        d. * …Bill knows that John loves Bill's mother.

Although opinion differs on exactly which LFs are licit for the first conjunct of (17), essentially everyone agrees that (19) is *not* licit:

coreference

(19)   * John₁ said that he₁ thinks that he₁ is intelligent.

binding
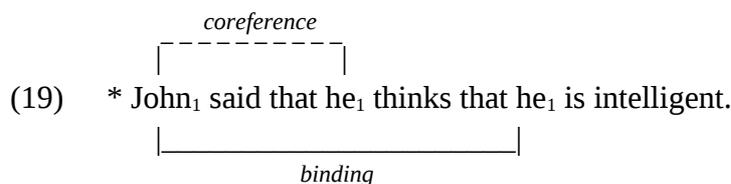
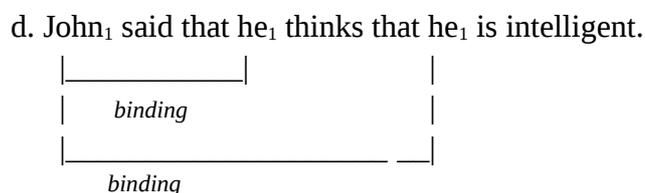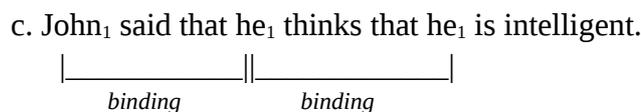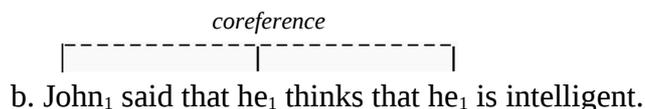Given a strict parallelism constraint on VP ellipsis, ruling out (19), and permitting (20a-d) is sufficient to capture the pattern in (18):

coreference

(20)   a. John₁ said that he₁ thinks that he₁ is intelligent.

binding

coreference

b. John₁ said that he₁ thinks that he₁ is intelligent.

c. John₁ said that he₁ thinks that he₁ is intelligent.

binding   *binding*

d. John₁ said that he₁ thinks that he₁ is intelligent.

binding

binding
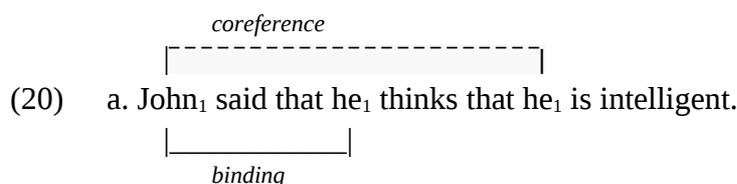
Fox (2000) analyzes Dahl's paradigm in terms of Rule H:

(21)   Rule H:
         A pronoun, α, can be bound by an antecedent, β, only if there is no closer
         antecedent, γ, such that it is possible to bind α by γ and get the same semantic
         interpretation.

Fox does not assume a strict parallelism constraint.[6] However, his relaxation of parallelism is not directly motivated by Dahl's paradigm. Rather, it has to do with the examples discussed

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[6] Fox gives the following definition of parallelism:

NP Parallelism (Fox 2000, 117)
NPs in the antecedent and elided VPs must either
a. have the same referential value (Referential Parallelism) or
b. be linked by identical dependencies (Structural Parallelism)

in section 2.2. That is, for reasons independent of Dahl's paradigm Fox thinks that both the strict and sloppy interpretations of (22) can be derived with binding in the antecedent:

(22)   John thinks that he is intelligent and Bill does too.

(23)   a. John thinks that he is intelligent and Bill thinks that he is intelligent.   *(Sloppy)*
        |_____| |_____|

        b. John thinks that he is intelligent and Bill thinks that he$_{John}$ is intelligent. *(Strict)*
        |_____|

Hence, he also thinks that all available readings in Dahl's paradigm can be derived from (20c). However, if we take Rule H together with a strict parallelism constraint, the Dahl facts still follow.

> Fox's analysis of Dahl's paradigm is compatible with Hypothesis II (even though Fox does not in fact assume a strict parallelism requirement). If we take Rule H to be a "binding condition", however, it is not compatible with hypotheses I or U. Moreover, Roelofsen (2011) has identified serious empirical problems with Fox's analysis of Dahl's paradigm.

4.2. Reinhart (2006)

Reinhart (2006) presents an analysis of the Dahl paradigm which takes both (19) (=OOO) and (25) to be ruled out by the same constraint (a modified Rule I):

                    coreference
            ┌──────────┐
(24)   * John$_1$ said that he$_1$ thinks that he$_1$ is intelligent.
            |_____|
                    binding

(25)   * Who$_1$ did he$_1$ say t_1 likes John?

Roelofsen (2010) points out that there is a serious technical flaw in Reinhart's reformulation of Rule I which undermines her analysis of Dahl's paradigm. However, the ultimate source of this problem is Reinhart's long-standing opposition to the traditional Condition C. If we interpret Reinhart's analysis within a more traditional framework, it amounts to the claim that (25) and (19) are both Condition C violations.[7]

Heim (2007) says that Fox's account of Dahl's paradigm *relies on* this stipulative definition of parallelism. However, it seems to me that this is not strictly correct. It is other VP ellipsis phenomena which force Fox to relax parallelism in this manner.

[7] Although Fox (2000) does not give a detailed analysis of how Condition C effects can be analyzed in terms of Rule H, he does suggest in a footnote that this may be possible. Hence, one could read Fox and Reinhart as agreeing on the essential point that (19) is a Condition C violation (even if there is no actual Condition C).

At a certain level of abstraction, Reinhart and Fox agree on the correct analysis of the Dahl paradigm. (24) is the LF which must be ruled out, and it is a strong crossover violation. So why not just implement this analysis in a more traditional way, as in (26)?

(26)   *Sketch of an analysis of Dahl's paradigm:*
        Pronouns interpreted as bound variables are variables in the same sense that
        Case-marked trace is a variable in GB theory. Hence, (19) instantiates a strong
        crossover configuration (i.e., is a Condition C violation) in the same way as (25).

4.3. Why Rule H or Rule I rather than just (26)?

One might reject (26) simply on the grounds that it is stipulative, and gives no insight into *why* there are strong crossover effects in the first place. However, although Fox's original formulation of Rule H is quite simple and elegant, Roelofsen (2011) has shown that it faces significant empirical problems, and these can't be solved without some additional stipulations regarding parallelism and permissible indexations. As for Reinhart's (2006) account, this may not even be internally coherent (Roelofsen 2010). So, although (26) is stipulative, it is not obviously at any great disadvantage as compared to its competitors in this respect.

Did Fox, then, have any empirical justification for treating the Dahl paradigm in terms of Rule H rather than (26)? Rule H of Fox (2000) blocks not only (24) but also the co-binding LF (20d). Fox's main motivation defining Rule H in terms of a set of interpretatively equivalent comparison derivations is to account for the instances of "exceptional co-binding" discussed in Heim (1998):

(27)   Every politician$_1$ is worried that only HE$_1$ voted for him$_1$.
        |————————————————————————| |
        |————————————————————————————— ————|

In (27), a co-binding LF must be available in order to explain the absence of a Condition B violation, but ordinarily, co-binding must be blocked in order to ensure that Condition B cannot be obviated in (28):

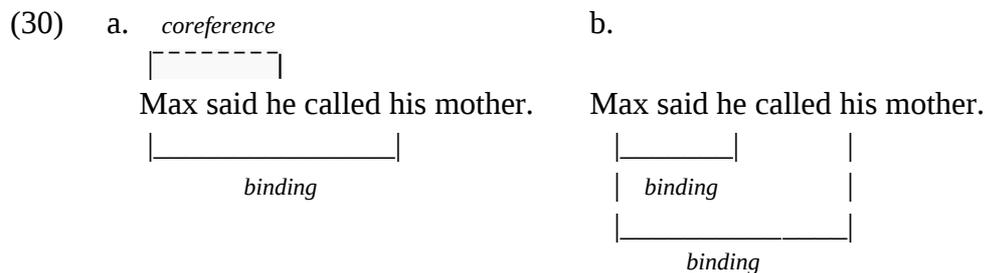(28)   * Every politician is worried that he$_1$ voted for him$_1$.
        |————————————————————| |
        |————————————————————————|

Co-binding is exceptionally permitted in (27) because it doesn't mean the same thing as (29):

(29)   Every politician$_1$ is worried that only HE$_1$ voted for him(self)$_1$.
        |————————————————————————||——————————|

If Heim (2007) is right to dismiss the theoretical significance of the exceptional co-binding cases, and if we give up the idea that Condition B applies only to binding relations, then there is not much motivation for blocking co-binding LFs. Indeed, Roelofsen (2011) has observed that there is some empirical motivation for permitting co-binding LFs. His Free Variable

Economy Condition, unlike Rule H, blocks only binding over a coreferential pronoun —
(30a) — and not co-binding — (30b):

(30)   a. *coreference*   b.
            ┌ ─ ─ ─ ─ ─ ┐
            | |
        Max said he called his mother.   Max said he called his mother.
        |_____| |_____| |
                binding | *binding* |
                                              |_____|
                                                      binding

It seems that if we are no longer concerned to block (30b), and if we have a formulation of
Condition B which blocks (28), then there is no longer any motivation for defining the
condition which blocks (30a) in terms of interpretatively equivalent comparison derivations.

In summary:

- The only LF that Rule H really needs to rule out to account for the Dahl paradigm is
  (24); it need not (and in fact probably should not) block co-binding.

- Although Rule H *can* still be formulated in terms of interpretatively equivalent
  comparison derivations, the Dahl paradigm itself provides no empirical motivation for
  doing so.

At this point, it seems that we might as well just replace Rule H with some form of Condition
C or a crossover constraint.

(Why doesn't Reinhart (2006) go this route? She wants to account for the familiar Condition
B/C obviation cases from Reinhart (1983), together with Heim's exceptional co-binding
examples. Again, none of this relates directly to Dahl's paradigm.)

> For historical reasons, it is widely assumed that Dahl's paradigm ought to be accounted for
> in terms of some condition stated in terms of interpretatively equivalent comparison
> derivations. But it has never been properties of the Dahl paradigm itself which motivated
> this assumption. The key motivations have been Heim's exceptional co-binding examples,
> and (for Reinhart at least) the classic Condition B/C obviation phenomena discussed in
> Reinhart (1983).

4.4. Taking stock: will Condition C plus strict parallelism do the job?

We could define Condition C as in (31).[8] This actually has the flavor of a "local" formulation of Rule H. That is, the change from Rule H to (31) is analogous to the change from the "global" shortest move of Chomsky (1993) to more recent "local" economy constraints.

(31)   Local Rule H version 1 **(does not permit co-binding)**
α cannot bind β as a variable if there is a γ covalued β such that α c-commands γ and γ c-commands β.

The intuition behind (31) is similar to that behind the original Rule H. Why bind a pronoun that is a long way away if there is a closer pronoun which could be bound to the same effect? The difference is simply that there is no reference to a comparison set of interpretatively equivalent binding alternatives. We are only interested in whether there is another way of covaluing α and β which uses a shorter binding dependency; we do not care if the interpretation thereby obtained is equivalent to the original. We can use Roelofsen's (2011) index trick to modify (31) to permit co-binding:

(32)   Local Rule H version 2 **(permits co-binding)**
An index ι cannot bind an index ι' as a variable if there is an index ι'' covalued with ι' such that ι c-commands ι'' and ι'' c-commands ι'.

(An index ι binds an index ι'' iff there are α_ι, $\beta_{\iota'}$ such that α_ι binds $\beta_{\iota'}$ as a variable.[9]

An index ι is covalued with an index ι' iff there are α_ι, $\beta_{\iota'}$ such that α_ι is covalued with $\beta_{\iota'}$.

An index ι c-commands an index ι' iff $\iota \neq \iota'$ and there exist α_ι, $\beta_{\iota'}$ such that α_ι c-commands $\beta_{\iota'}$.[10])

Roelofsen (200,2012) discusses a number of phenomena closely related to the Dahl's original paradigm which any analysis of Dahl's paradigm ought to be tested against. So, if we take (32) together with a strict parallelism constraint on VP ellipsis, how does it fare?

(33)   ✔   Forcing co-binding in the first conjunct
        ✔   Reverse Dahl effects
        ✘   Embedded Dahl effects

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[8] Without additional assumptions, (32) will not block *He[1] thinks that John[1] is intelligent*. This is also true of Fox's Rule H, which blocks strong crossover configurations, but does not obviously account for ordinary Condition C violations. Fox (2000,124fn14) suggests that this problem can be overcome by adapting a suggestion of Heim's. Heim proposes that proper names denote variables and introduce the presupposition that the variable is identical to a given individual. If these variables are eventually bound by a quantifier or some sort, then Rule H is violated if a co-indexed pronouns c-commands the name:
        * Quantifier[1] … John[1]/he[1] said that [x_1 John] is intelligent.

[9] In Heim-style LFs, we must allow the binder to be a lambda node if no additional constraints on indexation are imposed.. E.g., the index 2 is bound as a variable in a structure such as [Everyone[1] [λ_2 [… he[2]]]. One might also define covaluation over indices more directly, but here I wish to avoid making unnecessary many assumptions about the workings of the semantics.

[10] The condition that $\iota \neq \iota'$ simply makes explicit the usual convention that c-command is non-reflexive.

4.5. Forcing co-binding in the first conjunct

Roelofsen (2011) notes that (34) is problematic for Rule H[11], since the only LF compatible with strict parallelism — (35) — has co-binding in the first conjunct:

(34)   No student said that he liked his paper, but e.s. hoped that the teacher would.

(35)   No student said that he liked his paper, but e.s. hoped that T would ~~like his paper~~.
         |_____| | |_____|
         |_____|

Since Local Rule H does not block co-binding, (35) is available.

4.6. Reverse Dahl effects

Rule H correctly predicts that (37) is not a licit LF for (36):

(36)   Max claims that Bob called his mother, and Bob does too.

(37)   * Max claims that Bob called his mother, and B claims that B ~~called his mother~~ too.
           |_____| |_____|

However, Roelofsen (2011) notes that Rule H incorrectly blocks the LF in (39) for (38):

(38)   Every boy claimed that the jury loved his dish and added that he did too

(39)   Every boy claimed that the jury loved his dish and added that he ~~loved his dish~~ too.
           |_____| | |
           |_____ _____| |
           |_____ ___|

Again, since Local Rule H does not block co-binding, it does not block (39).

4.7. Embedded Dahl effects and Reinhart's (2006) analysis of Dahl's paradigm

With regard to Dahl's paradigm, it does not seem to matter much if the antecedent is a referential DP, a quantifier, or a bound variable. The following pattern is always illicit:

(40)   * X … [referential DP/pronoun] … pronoun
           |_____|

         (where X is a referential DP, a quantificational DP, or a bound variable, and the last
          two expressions are covalued)

However, Fox's and Roelofsen's analyses of Dahl's paradigm cannot give a unified explanation of why (40) is illicit for all of the different kinds of X. For example, Roelofsen

---

[11] In fact, Roelofsen is considering (34) in relation to a Binding Economy condition which is very similar to Rule H.

(2011) discusses sentences such as (41), which show abstractly the same pattern of available interpretations — (42) — as the classic Dahl paradigm in (17)-(18):

(41)   Every worker said that he knows when he can take home his tools,
         and that the boss does too.

(42)   *(Compare (18))*
         a. The boss knows when the boss can take home the boss's tools.
         b. The boss knows when the worker can take home the worker's tools.
         c. The boss knows when the boss can take home the worker's tools.
         d. * The boss knows when the worker can take home the boss's tools.

I will now argue that one of Reinhart's (2006) proposals can be combined with Local Rule H to provide a unified analysis of (40), and hence overcome the problem posed by embedded Dahl effects.

Reinhart (2006) introduces the idea that a pronoun may be interpreted via identification with a variable. It is typically assumed that *his* in (43a) may in principle relate to *John* in one of two ways: via binding or coreference. In contrast, *his* in (43b) must[12] either be a variable bound by *every boy* (the co-binding LF), or a variable bound by a variable bound by *every boy* (the transitive binding LF):

(43)   a. John$_1$ thinks that he$_1$ likes his$_1$ friends.
         b. Every boy$_1$ thinks that he$_1$ likes his$_1$ friends.

            ⇒ Every boy thinks that he likes his friends.
               |_____||_____|

            ⇒ Every boy thinks that he likes his friends
               |_____| |
               |_____ ___|

Reinhart proposes that there is second way in which *his* may come to be construed with *every boy* in (43b). The pronoun may identified with another variable bound by *every boy*:

(44)   Every boy (λx (x thinks that x likes his friends)) & he = x

We cache out the 'he = x' as follows:

(45)   Every boy (λx (x (λy (y thinks that x likes y's friends))))

The point here is simply that in formal terms, *his* in (44) is not a variable bound by *every boy* (since it translates as y rather than x in (45)). Note that (45) is distinct from a transitive binding configuration such as (46a), and a co-binding configurations such as (46b):

---

[12] Under interpretations in which both *he* and *his* are construed with *every boy*.

(46)   a. Every boy (λx (x thinks that x (λy (y likes y's friends))))   *(Transitive binding)*
        b. Every boy (λx (x thinks that x likes x's friends))   *(Co-binding)*

We now have in principle *four* possible LFs[13] for a [quantifier...pronoun...pronoun] configuration:

(47)   Every boy thinks that he likes his friends.

a. Co-binding:

Every boy (λx (x thinks that x likes x's friends))

Every boy thinks that he likes his friends.
      |_____| |
      |_____|

b. Transitive binding:

Every boy (λx (x thinks that x (λy (y likes y's friends))))

Every boy thinks that he likes his friends.
      |_____||_____|

c. First pronoun bound, second pronoun identified with first:

Every boy (λx (x (λy (y thinks that x likes y's friends))))

                        ┌──────┐
Every boy thinks that he likes his friends.
      |_____|

d. Second pronoun bound, first pronoun identified with first:

Every boy (λx (x (λy (y thinks that x likes y's friends))))

                        ┌──────┐
Every boy thinks that he likes his friends.
      |_____|

Now we can return to example (41), considering all of the possible LFs compatible with Local Rule H and the strict parallelism requirement:

---

[13] I suspect that Reinhart might not like to see these as "possible LFs" so much as "possible interpretations." Given the manner in which Reinhart (2006) states Rule I, it is not terribly important whether or not all of these interpretations have distinct LFs, or indeed whether there are such things as LFs.

(48)   *The simple strict/sloppy readings:*

    a. **Reading (MRRb)** *(Strict)*
      Every worker said that he   knows when he can take home his tools

```
        |_____|                    |                   |
        |_____ _____|                        |
        |_____ _____|
        |                    and TB k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
        |_____|                    |
        |_____ __|
```

    b. **Reading (MRRb)** *(Strict)*
      Every worker said that he   knows when he can take home his tools

```
        |_____|                ||_____|
        |_____ _____|
        |                    and TB k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
        |_____||_____|
```

    c. **Reading (MRRb)** *(Strict)*

```
                            ┌────────────┬──────────────┬────────┐
        Every worker said that he   knows when he can take home his tools      |
        |_____|            ┌────────────────┬──────────
                            and TB k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
```

    d. **Reading (MRRa)** *(Sloppy)*
      Every worker said that he   knows when he can take home his tools

```
        |_____||_____|                   |
                            |_____|
                            and TB k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
                            |_____|                   |
                            |_____ _____|
```

    e. **Reading (MRRa)** *(Sloppy)*
      Every worker said that he   knows when he can take home his tools

```
        |_____||_____||_____|
                            and TB k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
                            |_____||_____|
```

    f. **Reading (42c)** *(Sloppy)*
```
                                        ┌────────────┐
        Every worker said that he   knows when he can take home his tools
        |_____||_____|
                                        ┌───────────┐
                            and TB  k̶n̶o̶w̶s̶ ̶w̶h̶e̶n̶ ̶h̶e̶ ̶c̶a̶n̶ ̶t̶a̶k̶e̶ ̶h̶o̶m̶e̶ ̶h̶i̶s̶ ̶t̶o̶o̶l̶s̶ too.
                            |_____|
```

The available mixed reading:

g. **Reading (42c)**

Every worker said that he   knows when he can take home his tools

and TB   ~~knows when he can take home his tools~~ too.

The unavailable mixed reading has the following LF, which violates Local Rule H:

(49)

Every worker said that he   knows when he can take home his tools

and TB   ~~knows when he can take home his tools~~ too.

4.7.1. Caching out covaluation in the LFs for the available mixed reading

In Reinhart's quasi-semantic notation, (48g) comes out as follows:

(50)   EW (λx (x (λy (x said that x (λz (z knows when z can take home y's tools))
                    and that TB (λz (z knows when z can take home y's tools))))))

Note that the two ($\text{L}z$ …) expressions are formally identical. (50) is for all intents and purposes the same thing as (51), which corresponds to the LF (52):

(51)   EW (λx (x said that x (λz (z knows when z can take home x's tools))
                    and that TB (λz (z knows when z can take home x's tools))))

(52)   Every worker said that he   knows when he can take home his tools

                        and TB   ~~knows when he can take home his tools~~ too.

However, since (52) violates Local Rule H, the availability of (48g)/(50) is crucial to accounting for the embedded Dahl paradigm.

The Dahl paradigm itself does not appear to motivate the formulation of Rule H, or a similar constraint, as an economy condition.

Reinhart's (2006) proposal has the effect of allowing the same binding patterns for "Quantifer...pronoun...pronoun" and "Bound variable...pronoun...pronoun" as for "Referential expression...pronoun...pronoun." This permits a unified analysis of all instances of the pattern in (40).

(On another note, Reinhart's use of covaluation in stating her theory undermines some of the conceptual motivation for Rule I. If 'covalued' is already a term of the theory, why not simply state the binding conditions in terms of covaluation? We are left with only the empirical arguments for Rule I, which may not be very strong.)

5. Against economy analyses of SCO and Dahl's paradigm

- So far, I have argued that there is no empirical motivation for blocking LFs such as (24) using a condition stated in terms of a comparison class of interpretatively equivalent derivations. This section will argue that there is empirical evidence *against* doing so.

- If pronouns bound as variables are subject to strong crossover, why not weak crossover also? Although the data in this area are squishy, I will show some evidence that pronouns bound as variables are indeed subject to WCO.

5.1. Partial covaluation and interpretative equivalence

We have already seen in section 2.4 that the phenomenon of "overlapping reference" can pose problems for Rule-I-like constraints. We can show this using strong crossover effects as well as ordinary Condition B/C violations. (53b) appears to violate crossover because the trace is c-commanded by a pronoun with overlapping reference:

(53)   a. [Which of [the boys]$_1$]$_2$ t_2 said they$_1$ would win?
         b. ?? [Which of [the boys]$_1$]$_2$ did they$_2$ say t_2 would win?

This fact is hard to reconcile with a Rule-H-like constraint, since replacing *they* with a variable bound by the *wh*-phrase, or replacing the trace with a variable bound by *they*, would clearly not yield the same interpretation. We find the same phenomenon in pronominal binding. (54b) illustrates a Dahl effect in the absence of ellipsis:

(54)   a. [Each of [the boys]$_1$]$_2$ said that he$_2$ thinks they$_1$ are intelligent.
         b. ?? [Each of [the boys]$_1$]$_2$ said that they$_1$ think he$_2$ is intelligent.

We can construct similar examples using fake indexicals.[14] These give rise to ambiguities in certain kinds of focus construction:

---

[14] On fake indexicals, see e.g. Kratzer (2009, 1998), Heim (1994, 2005), Rullman (2004). Examples along the lines of (55) were first discussed in Partee (1989, fn3).

(55)   Only **I** think that I'm intelligent.

(56)   a. I am the only x such that x thinks I am intelligent.
          b. I am the only x such that x thinks x is intelligent.

This can be exploited to construct another variant of Dahl's paradigm:

(57)   Only **I** said I'd parked my car.

(58)   a. I am the only x such that x said x had parked x's car.
          b. I am the only x such that x said I had parked my car.
          c. I am the only x such that x said x had parked my car.
          d. * I am the only x such that x said I had parked x's car.

          a: John didn't say he'd parked his car, Mary didn't say she'd parked hers...(AWI)
          b: John didn't say I'd parked my car, Mary didn't say I'd parked it...(AWI)
          c: John didn't say he'd parked my car, Mary didn't say she'd parked it...(AWI)
          d: # John didn't say I'd parked his car, Mary didn't say I'd parked hers...(AWI)

As Rullman (2004), Heim (2005) observe, fake indexicals may be partially bound:

(59)   Out of everyone who's had a meeting with Mary
          ...only **I** said that we had a good discussion.

          = I am the only x such that [me and x] had a good discussion.

Once again, we can construct problematic examples using overlapping valuation:

(60)   Out of everyone who's had a meeting with Mary.
          ...only **I** said we met in my office.

(61)   a. I am the only x such that x said [x and Mary] met in x's office.
          b. I am the only x such that x said [me and Mary] met in my office.
          c. ? I am the only x such that x said [x and Mary] met in my office.
          d. * I am the only x such that x said [me and Mary] met in x's office.

5.2. Problem: defining overlapping valuation

To account for the preceding examples, Local Rule H would have to be redefined in terms of "overlapping valuation" rather than covaluation.

5.3. Weak crossover?

(62)   a. [Each of [the boys]$_1$]$_2$ said that he$_2$ thinks their friends$_2$ are intelligent.
        b. ? [Each of [the boys]$_1$]$_2$ said that their friends$_1$ think he$_2$ is intelligent.

(63)   John said that his brother loves his mother and Bill did too.

(64)   a. Bill said that Bill's brother loves Bill's mother.
        b. Bill said that John's brother loves John's mother.
        c. Bill said that Bill's brother loves John's mother.
        d. ? Bill said that John's brother loves Bill's mother.

Although the previous literature has, as far as I know, uniformly taken (64d) to be an available reading of (63), it has sometimes been noted that it is the least accessible of the available readings (e.g. Fiengo & May 1994).

There are also examples such as (65)-(66) from Kehler (1993), where the existence of a Dahl effect in the absence of c-command is acknowledged:

(65)   Edith said that finding her husband nude had upset her, and Martha did too.

(66)   a. …Martha said that finding Martha's husband nude had upset Martha.
        b. …Martha said that finding Edith's husband nude had upset Edith.
        c. …Martha said that finding Martha's husband nude had upset Edith.
        d. * …Martha said that finding Edith's husband nude had upset Martha.

5.4. Summing up: the proposed analysis of Dahl's paradigm

I have suggested that there is a viable analysis of Dahl's paradigm (and related phenomena) with the following key features:

- VP ellipsis is subject to a strict parallelism constraint.

- A pronoun may be interpreted via identification with a bound variable (Reinhart 2006).

- Pronouns bound as variables are subject to strong crossover effects. This can be captured via a condition such as Local Rule H.

- Conditions B and C are stated in such a way that all of (i)-(ii) and (iii)-(iv) are illicit:

    (i)   * John likes him   *(Binding)*
            |_____|

    (ii)   * ┌ ─ ─ ─ ─ ─ ─ ┐   *(Coreference/covaluation)*
        John likes him

    (iii)   * He thinks that John is intelligent.   *(Binding)*
            |_____|

         * ┌ ─ ─ ─ ─ ─ ─ ─ ─ ┐   *(Coreference/covaluation)*
    (iv)   He thinks that John is intelligent.

If all of the above works out, we have overcome one of the the main barriers to developing a version of Heim's (2007) theory which is consistent with hypotheses I and II.

6. Conclusion

i.   Hypotheses I and II are still viable.

ii.   There is a "semantic hump" in the theory of binding and ellipsis. Something, somewhere, has to be formulated in such a way that it does not care too much about the difference between binding and coreference in cases where these are interpretatively equivalent. If you try to push down the hump in the core binding theory, it comes back up in the theory of ellipsis (in the parallelism constraint), and vice versa.

iii.   The good news for the Un-Cartesian linguist: (i)

iv.   The bad news: (ii)

7. Open problems

- If there is no ban on co-binding, this raises the question of why the parasitic gap cannot c-command the real gap, or vice versa. Traditionally, this was analyzed as a Condition C effect.

- Fox (2000), following Dahl, has provided an independent argument against a strict parallelism constraint on VP ellipsis. I have not addressed this.

- I have not considered the use of Rule-I-like constraints in the analysis of local anaphoric binding (Reuland 2001). Phenomena in this domain may still motivate the use of such constraints.

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