Focus on Cataphora: Experiments in Context

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Abstract

Since Chomsky 1976, it has been claimed that focus on a referring expression blocks co-reference in a cataphoric dependency (*His_i mother loves $JOHN_i$ vs. His_i mother LOVES $John_i$). In three auditory experiments and a fourth written questionnaire, we show that this fact does not hold when a referent is unambiguously established in the discourse (cf. Williams 1997, Bianchi 2010) but does hold otherwise, validating suggestions in Rochemont 1978, Horvath 1981, and Rooth 1985. The perceived effect of prosody, we argue, building on Williams' original insight and deliberate experimental manipulation of Rochemont and Horvath's examples, is due to the fact that de-accenting the R-expression allows hearers to accommodate a salient referent via a Question Under Discussion (QUD) (Roberts 1996/2012, Rooth 1996), to which the pronoun can refer in ambiguous or impoverished contexts. This heuristic is not available in the focus cases, and we show that participants' interpretation of the pronoun is ambivalent here.

KEYWORDS: cataphora, focus, de-accenting, question under discussion

1 Focus and Cataphora

Since Chomsky 1976, it has often been repeated that backward anaphora is blocked if the 'antecedent' receives focus. This is illustrated by the purported contrast in

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the answers to the questions in (1). These examples, and judgments, are from Bianchi 2010.[1]

(1) a. As for John, who does his wife really love?

$^{?}$*His$_i$ wife loves JOHN$_i$.

b. As for John, I believe his wife hates him.

You're wrong: His$_i$ wife LOVES John$_i$.   (Bianchi 2010, p.5 (2),(3))

Chomsky 1976 used these data to argue for a rule of covert focus movement. The disjoint reference effect in (1a) is thereby reduced to an instance of weak crossover (WCO) as in *Who$_i$ does his$_i$ mother love? or *His$_i$ mother loves everyone$_i$.

Since then, the purported contrast in (1) has been attributed to the interaction of focus and cataphoric configurations at the discourse level. Williams 1997 suggested that cataphoric configurations like (1) always involve a previous discourse antecedent (possibly implicit). He claims that a focused R-expression is at odds with this kind of anaphoricity to a discourse antecedent. Moreover, Bianchi 2010 claims that (1a) contrasts with the cases in (2), where the DPs are either both pronouns or R-expressions.

(2) As for John, who does his wife really love?

a. His$_i$ wife loves HIM$_i$.

b. John$_i$'s wife loves JOHN$_i$.   (Bianchi 2010, p.6 (8c))

As (2b) demonstrates, focus is possible on discourse anaphoric R-expressions when not preceded by a pronoun. The reader is referred to Bianchi for the details. The

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[1]Chomsky's original examples (i) gave no indication of what type of focus is involved, nor a context.

(i) a. The woman he loved BETRAYED John.
     b. *The woman he loved betrayed JOHN.   (Chomsky 1976, p.344)

important feature of both Williams 1997 and Bianchi 2010 is that the effect can arise when the pronoun in a cataphoric configuration finds a unique linguistic antecedent in the discourse.

In this article, we provide experimental evidence that there is no contrast between the answers in (1a) and (1b) when presented in contexts such as these. We nonetheless show, with further experimentation, that a contrast like the one Chomsky suggests *does* emerge in impoverished contexts. Our results paint the following picture: it is not that focus rules *out* co-reference in *His$_i$ wife loves JOHN$_i$*. Rather, de-accenting promotes co-reference in *His$_i$ wife LOVES John$_i$* above the base-line expected of a fully ambiguous context. The reason for this, we argue, naturally follows from the way focus/de-accenting helps set a Question Under Discussion (Roberts 1996/2012). This has the result of making the referent of the de-accented expression salient, which in turn makes it a likely referent for the pronoun thus promoting co-reference.

2   A little history and a new direction

Doubts about whether there really is a contrast like that reported for (1) surfaced early in the literature. Rochemont 1978 and Horvath 1981 (see also Horvath and Rochemont 1986) presented clear cases where contrastive focus on an R-expression is possible in a cataphoric configuration (3)[A2].

(3)   A1: Sally and the woman John loves are leaving the country today.

        B1: I thought that the woman he loves had BETRAYED Sally.

        A2: No, the woman he$_i$ loves betrayed JOHN$_i$. Sally and she are the best of friends.

While Horvath 1981 and Rooth 1985 claim that the effect does not arise in contexts like (3)—and as we confirm experimentally contexts like (1)—they nonetheless claim that an effect of prosody on cataphora *does* arise with *bound* variable cataphoric dependencies. Rooth (1985, p.69 (59)) illustrates this with cases where the 'antecedent' is quantified by *only*, as in (4):

(4)   a.   We only expect the woman he loves to betray JOHN.

   b.   Bound: John is the only x such that we expect the woman x loves to betray x.

   c.   Referential: John is the only x such that we expect the woman John loves to betray x.

The cataphoric configuration in (4) lacks the bound variable reading. If the prohibition against focus on the antecedent in cataphora only holds for bound variable readings, then, Horvath suggests, the effect Chomsky identified should be limited to cases that preclude direct reference for the pronoun. We would expect, then, that in impoverished contexts, the initial pronoun will not find a discourse antecedent or salient referent, and so will seek its interpretation via binding. This would involve covert movement of the referring expression (5b), which is possible since on Horvath's account the focused element raises at LF. This will give rise to a WCO violation, giving disjoint reference.

(5)   a.   His mother greeted JOHN.

   b.   JOHN $\lambda 1$ his$_1$ mother greeted 1.

The idea that non-quantificational expressions like proper names can induce WCO is not implausible. While Lasnik and Stowell 1991 claim that referential expressions, unlike true quantificational ones, do not induce crossover effects (6) (so-

called *weakest crossover*), Ruys 2004 and Büring 2005 show that such cases merely involve co-reference, not semantic binding, in which case WCO is not expected to obtain.

(6)   a.   John$_i$ I believe his$_i$ mother loves ___.

        b.   This book$_i$ I would never ask its$_i$ author to read ___.

               (Lasnik and Stowell 1991, p.697 (33))

Ruys' evidence for WCO with non-quantificational expressions comes from the lack of sloppy readings in bare argument ellipsis with crossover in (7a), compared to (7b), where there is no crossover.[2]

(7)   a.   Linda, her dog hates ___, but not Susan ~~her dog hates ___~~.

               ✓strict, ✗sloppy (Ruys 2004, p.135 (18))

        b.   Linda, I think ___ loves her dog, but not Susan ~~I think ___ loves her dog~~.

               ✓strict, ✓sloppy

Since the sloppy reading can only arise from binding, its absence in (7a) suggests that in the attempt to establish a semantic binding relation, the referring expression induces WCO. This means that treating (5a) as a case of WCO is at least tenable. Horvath's solution relies on focus requiring movement, which remains a point of debate (see Krifka 2006, Wagner 2006, Erlewine and Kotek 2016b for movement approaches to focus).[3] But, even more critical is that the Rooth-Horvath approach makes empirical predictions that we will see are not borne out in our experiments:

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[2]Lasnik and Stowell argue that weakest crossover does allow sloppy readings (see their example (34), p.697) but Ruys 2004 shows that these sloppy readings arise from a source distinct from semantic variable binding, like similar cases discovered by Fiengo and May 1994 and Tomioka 1996.

[3]Rooth does not suggest focus drives movement, but that movement is needed to establish a binding relation. As a reviewer points out, this raises questions about the trigger of such movement. Moreover, it is not clear how Rooth connects this to focus.

they predict that focus on the antecedent in an impoverished context will rule out co-reference. What we find, however, is that co-reference is not ruled out; it is just at par with non-co-reference in these contexts.

We would like to suggest that there exists a third possibility for the perceived contrast, which trades on Horvath's intuition that Chomsky's effect emerges when there is no salient referent. We call it the *Focus Disambiguation Hypothesis* (FDH). The FDH reverses how we typically see the contrast. It is not that focus rules *out* co-reference in *His$_i$ wife loves JOHN$_i$*. Rather, de-accenting promotes co-reference in *His$_i$ wife LOVES John$_i$* above the base-line expected of a fully ambiguous context. The idea is that, in general, when there is no salient or unique referent available for the initial pronoun in a cataphoric dependency (unlike the contexts reported in (1) but like the contexts we test in Experiments 2a, 2b and 3), both co-reference and non-co-reference are possible. The perceived effect comes from de-accenting the R-expression. Focus structure helps establish, or elaborate, a Question Under Discussion (QUD) (Roberts 1996/2012, Rooth 1996). The QUD can play a role in making certain things salient: a referent mentioned in the QUD is going to be more salient than one that isn't. And, it goes without saying, pronouns gravitate to salient referents. To illustrate, the focus alternatives invoked when the R-expression is de-accented are in (8).

(8)   His mother [$_F$ loves] John.

Focus Alternatives:

{His mother hates **John**, His mother adores **John**, His mother tolerates **John**, His mother likes **John**, ...}

The referent John occurs in *all* the focus alternatives—salient indeed. In an ambiguous or impoverished context, this will have the effect of making John more

salient than those referents not implied as salient, and so the more likely referent for a pronoun. In contrast, while uttering (9) does not preclude John from being salient, its alternatives do not contain reference to John.

(9)   His mother loves [$_F$ John].

Focus Alternatives:

{His mother loves **Bill**, His mother loves **Fred**, His mother loves **Roger**, His mother loves **Patrick**, ...}

In establishing reference in an ambiguous or impoverished context, then, the alternatives in (9) are of 'no help', so to speak. And so in such a context we do not expect a preference for co-reference. In fact, we might expect the choice to be at chance and the unresolvable ambiguity to result in a perceived reduction in acceptability. The source of linguists' intuitions about this contrast regarding focus and cataphora, we claim, is simply that in ambiguous or impoverished contexts, the referent of the pronoun in *His mother loves JOHN* is undetermined; but in the same contexts, the focus structure of *His mother LOVES John* makes it easier to construe, and when paired alongside its ambiguous counterpart, appears the grammatical of the two.

We report four experiments in support of the FDH. In Experiment 1, we first show that when a unique, overt antecedent is provided in advance of the cataphoric pronoun as in (1), participants allow focus on the R-expression (contra Williams 1997 and Bianchi 2010). However, Experiment 2a shows that in contexts where the cataphoric pronoun is ambiguous, an effect of focus emerges. We argue that this follows naturally from the FDH, and not from any of the extant accounts of the contrast. Experiment 2b shows that the effects found in Experiment 2a cannot be attributed to a WCO effect in the question portion of the stimuli. Taken

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together, Experiments 1 and 2a,b support the FDH. Experiment 3 shows that the effect of prosody holds when *no* referents are available for the pronoun and further demonstrates that the effect can be replicated without auditory stimuli.

3 Experiment 1

Experiment 1 tested examples similar to those in (1) given by Bianchi 2010.[4] Two two-level factors were crossed to create the four conditions in (10): Prosody (*Accented* vs. *De-accented*) x DP-TYPE (*R-expression* vs. *Pronoun*). Bianchi predicts an interaction, such that co-reference will be available in both *Pronoun* conditions, and in *De-accented/R-expression*, but not *Accented/R-expression*. Rooth and Horvath predict no effect of prosody in either case, since the initial pronoun in the answer can be interpreted as referential because a salient referent is provided in the question.

(10) a. Who did John's wife hug? His wife hugged John.   *Acc/R-exp*

b. Who hugged John? His wife hugged John.   *De-acc/R-exp*

c. Who did John's wife hug? His wife hugged him.   *Acc/Pron*

d. Who hugged John? His wife hugged him.   *De-acc/Pron*

Materials, Procedures and Participants   16 sets of stimuli like (10) were created and recorded by a trained male and female speaker, counter-balancing the question and answer roles. The questions served to ensure that the prosody of the answer

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[4]For the test trials in the *De-accented* condition, we chose to focus the subject DP—e.g. *wife*—not the verb as in Bianchi's original examples. We leave it for future research to determine whether predicate focus will give the same results. Also, as a reviewer points out, a further question to ask is the effect of *own* (*His own mother loves John*), which alongside *only* and *even* are known to alleviate overt WCO (Postal 1993). We hope to explore this in future studies.

was appropriate. There were 29 fillers, which included a variety of grammatical and ungrammatical co-reference relations.

The experimental task was adopted from Gordon and Hendrick 1997: participants (N=31) were first trained by the experimenter to answer whether two highlighted words in green could be co-referent using two clear cases of forward pronominal co-reference and one clear Principle B violation.[5] In the experimental trials, participants heard the question while viewing a blank screen. Afterwards, participants were automatically advanced to a display of the written answer with the audio. They were asked "Can the two parts in green refer to the same person? Yes (Y) or No (N)." 31 native English speaking members of the university community were tested in 20 minute session and received either $10 or course credit.

Results and Discussion The mean proportions of co-reference (Y) responses for each condition are shown in Figure 1. A mixed model was fit with DP-TYPE and PROSODY as fixed factors and item and participant as random factors. A main effect of DP-TYPE was found (Est.=-1.48457, SE=0.13680, z=-10.852 p<.001), but no effect of PROSODY and no interaction. Pairwise comparison (TukeyHSD()) of *Acc/R-exp* and *De-acc/R-exp* was not significant (p>.35).

Contrary to claims in the literature, focus on an R-expression in a cataphoric configuration does not rule out co-reference. The overall means of the R-expression conditions (66%) differed from chance (t(30 = 3.312, p = .002)). The main effect of DP-TYPE merely reflects the marked status of cataphora in general.[6]

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[5]We chose to highlight the terms in green and not in bold as Gordon and Hendrick did to avoid the possibility that bold would be associated with prosodic prominence.

[6]This may be why the examples in (2) are judged better than (1), since they do not involve cataphora in the usual sense of pronoun followed by R-expression.
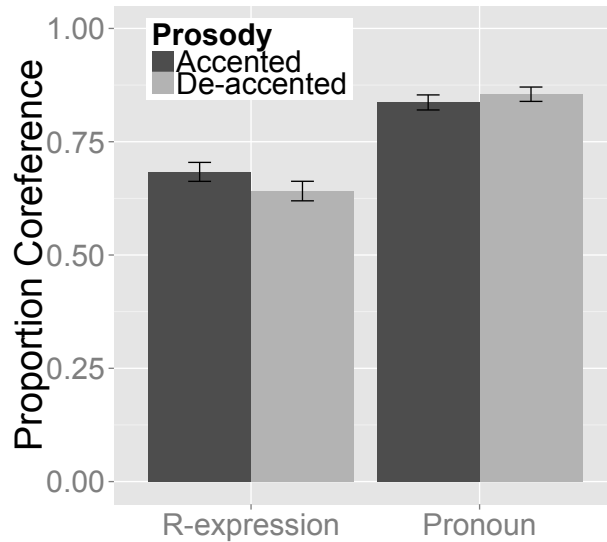
Figure 1: Mean proportion of co-reference responses (N=31) and standard error

We note that participants did show disjoint reference effects for filler material, and in a way that suggests they were sensitive to prosody. Focus sensitive operators like *only* and *even* have been argued to bleed Condition B (Reinhart 1983). Heim 2009 argues that even in the absence of such particles, the presence of focus on the antecedent licenses exemption from Condition B as in (11).

(11)   Who voted for Max?

         He HIMSELF voted for him.   (Heim 2009: ex. (26))

One set of fillers tested this effect with pairs of sentences such as (12), pronounced with prosodic prominence on the reflexive.

(12)   a.   She HERSELF believes her.   .77

       b.   She believes her HERSELF.   .54

Bianchi's 2010 appeal to Minimize Restrictors! (Schlenker 2005) would predict this, but as we see, there is no interaction with prosody.

The proportion of co-reference responses was 77% for (12a) as compared to 54% for (12b), and this difference was significant (Est.= -1.9513, SE=0.2410, z=-8.097, p<.001). We take this as suggesting that participants were willing to give non-co-referent responses, and in a way that is arguably mediated by prosody. The fact that focus on the R-expression did not affect co-reference in cataphoric configurations is therefore plausibly diagnostic of the absence of such an effect.

Gordon and Hendrick 1997 also investigated cataphora experimentally, but without manipulating focus. They report much lower acceptance rates for co-reference—28% in their Experiment 1 and 33% in their Experiment 3. These rates are not much higher than what they found for Condition C violations *He_i met $John_i$'s roommate at the restaurant*. Their Experiments 1 and 3 differ from our Experiment 1 in that no previous referent was provided for the pronoun. However, in another experiment (their Experiment 5), using a 5-point scale acceptability rating task, Gordon and Hendrick found that acceptance rates for co-reference in intra-clausal cataphora increased (3.24), in comparison to Condition C violations (2.43), regardless of the presence/absence of a preceding question with a referent. In any event, as a reviewer points out, what is at issue is not absolute levels of acceptability but the difference between the manipulated conditions. Unlike Gordon and Hendrick, our materials were presented auditorily, which may have an ameliorating effect overall. Comparing across experiments with different tasks and stimuli should be conducted with caution. Nevertheless, the general trend that intra-clausal cataphora is more acceptable than Condition C violations is attested in both our results and Gordon and Hendrick's results.

4 Experiment 2

Experiment 1 found no effect of prosody on cataphoric configurations in the sort of discourses that Williams and Bianchi suggested would show such an effect. The questions in the stimuli of Experiment 1 contained a salient referent for the pronoun. As Rooth and Horvath predicted, co-reference is permitted here in spite of focus on the R-expression. In the next two experiments, we prevent participants from easily finding a discourse referent for the pronoun and instead provide two possible referents in a visual display accompanied by a question-answer pair audio. In Experiment 2a, we show that the claimed effect of prosody *does* emerge in these contexts. Experiment 2b rules out that this result is merely due to a WCO violation that is present in the non-target question portion of the stimuli.

4.1 Experiment 2a

Materials, Procedures and Participants   Experiment 2a compared discourses in which the R-expression in an answer was *De-accented* or *Wh-Focus*. Unlike Experiment 1, the question contained a pronoun, not an R-expression.

(13)   a.   Who greeted him?

His [$_F$ mother] greeted Benny.   *De-acc*

   b.   His mother greeted which guy?

His mother greeted [$_F$ Benny].   *Wh-Focus*

We chose a D-linked *wh*-phrase (*which guy*) for the question in (13b) in an attempt to mitigate a WCO violation in the question, which might alone preclude co-reference independently of the prosody of the answer. Falco 2007, building on Pesetsky 1987, has argued that WCO effects are absent, or at least mitigated, with

D-linked *wh*-phrases. We also chose to present the questions as an echo-question, as we felt that a WCO violation was even less acute. Experiment 2b further addresses the issue of WCO in the question.

The design deliberately delays participants' ability to interpret the referent of the pronouns (even those in the question) until the prosody of the final R-expression is processed. We grant that this makes the dialogue more challenging to the participants. We enhanced the naturalness of the dialogues by presenting the question in all conditions as an echo question, suggesting a dialogue in progress. However, even if these dialogues proved difficult for participants, they would be equally so across all experimental conditions, and so any contrast we observe between conditions would be telling.

The stimuli were recorded by two trained female native speakers of Canadian English. The two speakers alternated question and answer roles.

The experiment employed a picture-based forced-choice task. Participants (N=48) heard the question and the answer while viewing the first screen (Display 1, Figure 2), which introduced four characters and their names. In the case of (13), these were Benny, his mother, and a competitor referent, Larry, and his mother. After a delay of 800 milliseconds, the computer automatically advanced to the second screen (Display 2, Figure 2), which presented pictures of the possible referents for the subjects of the target answer (Benny's mother, Larry's mother). The position of the individuals was counter-balanced in the following way: a character and his/her mother/sister/brother or relevant relation (including the screen with just his mother) were always in the same column, but which side of the screen they were on was fully counter-balanced. Participants were asked to click on the image of the individual to answer the question: *The question you just heard was about Benny and WHO?* Given the genitive relation, the participants' responses

correspond to their interpretation of the pronoun as co-referent or not with the R-expression in the target answer sentence. The repetition of *Benny* in this question does promote that referent's salience over Larry—something that will in itself promote co-reference. But this holds equally across experimental conditions.
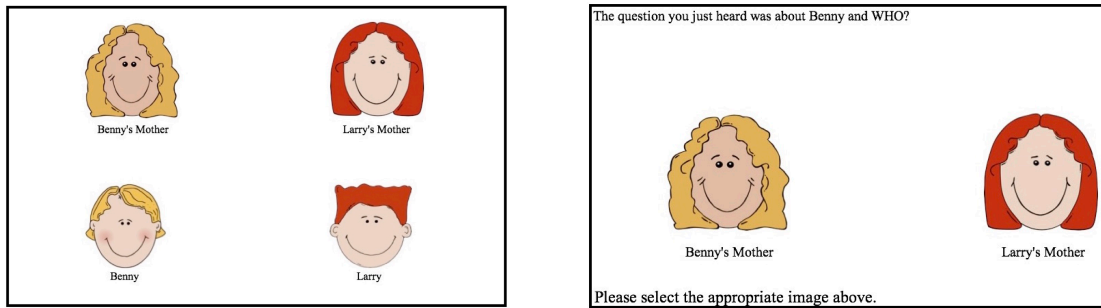

Figure 2: Display 1 (left) and Display 2 (right)

We saw in Experiment 1 that there is no categorical, grammatical prohibition on focusing an R-expression in a cataphoric dependency, at least when a salient antecedent is provided. In fact, there was a preference for co-reference. The context in this experiment provides referents for the pronoun, but not unambiguously so. The FDH predicts the *Wh-Focus* condition to be merely ambiguous, and we would expect participants to choose a referent for the pronoun at essentially chance. The FDH, however, predicts that the de-accented R-expression will promote co-reference responses in comparison.

In addition to the two test conditions above, Experiment 2a included a third condition which bore broad focus on the VP (*VP-Focus* condition), as in (14).

(14)   His mother did what? His mother [$_F$ greeted Benny].   *VP-Focus*

The answer was pronounced with nuclear stress on the sentence-final proper name. The purpose of *VP-Focus* is to tease apart whether focus-marking (i.e. the *Wh-Focus* condition) is responsible for ruling *out* co-reference or whether de-accenting

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is responsible for ruling *in* co-reference. In the *VP-Focus* condition, the referring expression is not de-accented nor does it receive focus-marking. If focus-marking on the R-expression is alone responsible for the disjoint reference effect, then the *VP-Focus* cases will pattern like the de-accented conditions. On the other hand, if de-accenting alone is responsible for alleviating a disjoint reference effect, we predict the *VP-Focus* cases to pattern like the *Wh-Focus* conditions. Furthermore, there is no WCO violation in the question, so any disjoint reference effect in this case will be due to the answer, not the question.

Sixteen item sets were created, generating three separate lists prepared in a Latin Square design, and participants were assigned to one of these lists. The experiment contained 59 fillers, which included both grammatical and ungrammatical anaphoric relations.[7]

Results and Discussion The mean proportions of co-reference responses are shown in Figure 3. Pairwise comparison using the TukeyHSD() function revealed a significant difference between *De-acc* and *Wh-Focus* (p<.0001) and *De-acc* and

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[7]The fillers were either instances of (ia) grammatical but biased pronominal anaphora; (ib) un-biased, cross-clausal forward pronominal anaphora; (ic) mono-clausal forward pronominal anaphora; (id) ungrammatical cataphora (condition C violation). The mean proportion of co-reference responses is reported as percentages for each example.

(i)   a.   Who did what?
Benny's mother took him to his parents' house.   45%
    b.   What did they say?
Benny's mother said he was screaming too loud.   61%
    c.   Who was he disciplined by?
Benny's mother disciplined him.   57%
    d.   What happened?
He was discovered by Benny's mother.   21%

These responses demonstrate that the task produced the expected responses for ungrammatical sentences (Condition C in (id)). Further, they offer a base-line proportion of co-referent responses for non-biased, grammatical but ambiguous forward anaphora (57%–61%).

VP-Focus (p<.05), but not between *Wh-Focus* and *VP-Focus* (p>.05). Contrary to Experiment 1, focus on the R-expression affects co-reference responses, regardless of the type of focus.
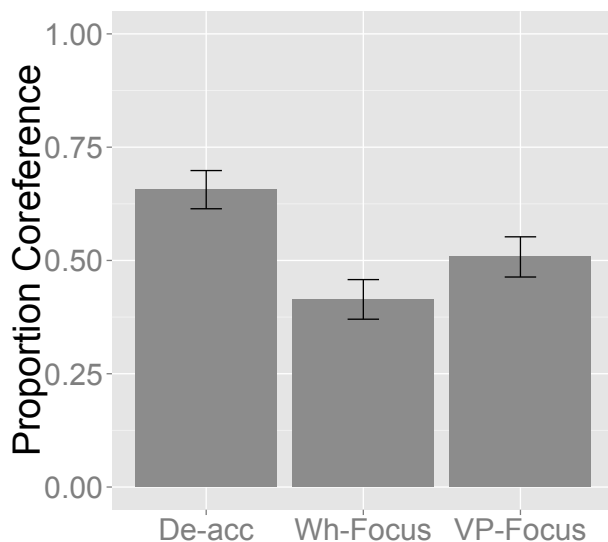

Figure 3: Mean proportion of co-reference responses (N=48) and standard error

The effect of prosody emerges when no unique, salient linguistic antecedent is given, suggesting that the effect Chomsky originally identified is real, but only emerges if participants cannot easily establish a referent for the cataphoric pronoun (unlike in Experiment 1). This is consistent with the FDH. We found that co-reference is not completely ruled out with *Wh-Focus* (41.4%)—as, say, compared to the Condition C fillers (21%)—suggesting that both referents are possible simply because the context is fully indeterminate. The role of de-accenting is in *promoting* co-reference in comparison to the other conditions. Co-reference responses for *De-accented* was greater than chance (66%; t(23) = 3.4174, p = 0.002). *VP-Focus* was no different from chance (51%; t(23) = 7.2256e-10, p = 1) and *Wh-Focus* was marginally different from chance (41.4%; t(23) = -2.0641, p = 0.0505). The slightly

lower proportion of co-reference in the latter case could be due to a very weak effect of WCO in the question (see below).

The predictions we have attributed to the Rooth-Horvath approach were not completely borne out. Given the presence of referents for the pronoun—the labeled pictures of Larry and Benny in Figure 2—participants did not need to resort to a WCO-inducing binding relation to attain co-reference, and still there was an effect of prosody.[8]

Particularly instructive is the fact that the *VP-Focus* conditions patterned statistically like *Wh-Focus*. This is not expected by previous analyses of the pattern, since in these cases the R-expression is neither de-accented nor focus-marked (it is part of a focus-marked constituent, and in our stimuli it only bears the low-pitch prosody of nuclear stress in a sentence final-position). FDH offers a natural way to understand why the *VP-Focus* condition patterns like the *Wh-Focus* condition. The alternatives generated by VP focus could be of the following form in (15), with wholesale replacement of VP meanings.

(15)   His mother did what? His mother [$_F$ greeted John].

Focus Alternatives:

{His mother read a book, His mother walked home, His mother ate a sandwich, . . .}

None of these alternatives reference John, so they do not evoke a QUD which references John, and so there is no motivation for the hearer to accommodate John as a salient referent. Without this prosodic guide for resolving the cataphoric pronoun,

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[8]While a number of authors have argued for a theoretical principle that prefers binding over co-reference (Grodzinsky and Reinhart 1993)—something that might predict WCO to discriminate against co-reference even in the presented contexts— experimental evidence for such a principle has not yet been found (see Frazier and Clifton 2000 and Cunnings et al. 2014).

both referents are chosen at roughly equal chance (modulo whatever markedness cataphora in general invokes). Again, the generalization is not that focus blocks co-reference, but that de-accenting guides reference in such ambiguous cases.

The *VP-Focus* results are also of relevance to the possible confound in the *Wh-Focus* condition, the question for which may itself contain a WCO violation. The *VP-Focus* condition does not contain even a possible WCO violation in the question, and still an affect of prosody emerges in comparison to the de-accented conditions. We cannot attribute the lowered rates of co-reference in these conditions to a co-reference-blocking WCO configuration in the question prompt. In Experiment 2b, we remove this confound in the narrow focus conditions.

A reviewer asks why the De-accented sentences are not more acceptable— why for instance, participants are still not very firm in these cases. First, it is always difficult to make conclusions such as these from raw numbers. Moreover, compared to unbiased forward anaphora fillers (57%–61%) our de-accented cataphora cases fare quite well. We should not expect categorical judgments in these matters, at least not in the case of intra-clausal cataphora.

4.2 Experiment 2b

Experiment 2b was conducted to further control for a possible confound of WCO in the question in (13b), *Wh-Focus*, by using the passive voice in the questions, as in (16). 16 stimuli sets were recorded with one two-level factor, Prosody (*De-accented* vs. *Wh-Focus*).

(16)   a.   Who was he greeted by?

          His [$_F$ mother] greeted Benny.   *De-acc*

        b.   Who was greeted by his mother?

His mother greeted [$_F$ Benny].   *Wh-Focus*

While the active-passive mismatch is not perfectly natural, it is present in both conditions and we have no reason to believe that the two conditions would interact differently with such degradation. The stimuli (including 59 fillers) were recorded according to the same procedure as in Experiment 2a, and the picture-based forced-choice task and procedures were identical as well.

Results and Discussion   The mean proportion of co-reference responses for 48 participants is shown in Figure 4. A mixed model was fit with PROSODY as a fixed factor and item and participant as random factors, and it revealed a significant effect of PROSODY (Est.=-0.6702, SE= 0.2914, z=-2.3, p<0.05).
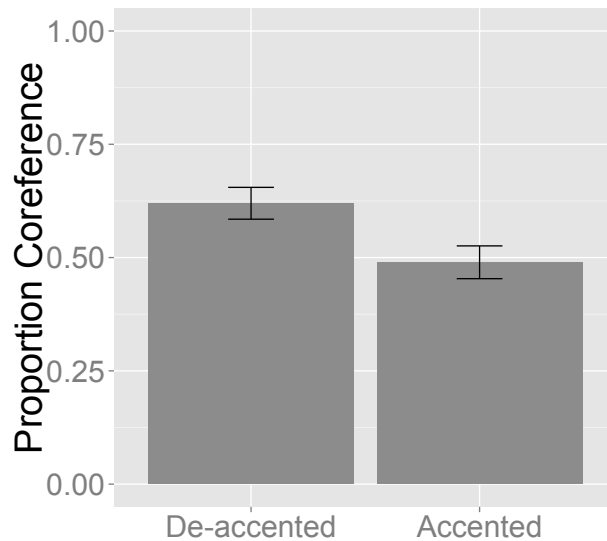

Figure 4: Mean proportion of co-reference responses (N=48) and standard error

In addition to the comparison between *VP-focus* and *De-accented* in Experiment 2a, the results of Experiment 2b show that the presence of a WCO violation

in the stimuli questions cannot alone account for the difference in co-reference responses that emerges due to prosody in the target answer.

5 Experiment 3

Experiments 2a,b set up contexts where the cataphoric pronoun was able to refer to one of two referents, but not unambiguously so. The results showed that the perceived effect of prosody is due to the fact that de-accenting guides the hearer to promote one of these two possible referents as discourse salient via the QUD. In this experiment we test whether de-accenting can guide interpretation when no previous referents are provided—linguistically or otherwise. Furthermore, Experiment 3 solidifies our interpretation of the previous results by comparing contexts with a referent for the pronoun (as in Experiment 1) to contexts without a referent in the same experiment using the same task.

Two factors were crossed to create the four conditions below: QUESTION FORM: whether an R-expression (i.e. an antecedent) was presented in the question (*R-exp in Q*) or not (*No R-exp in Q*); and PROSODY: whether the R-expression in the answer is *De-accented* or *Accented*, i.e. bearing *wh-focus*.

(17) a. Who hugged John?

His [$_F$ wife] hugged John.   *R-exp in Q/De-accented*

b. Who did John's wife hug?

His wife hugged [$_F$ John].   *R-exp in Q/Accented*

c. Who hugged him?

His [$_F$ wife] hugged John.   *No R-exp in Q/De-accented*

d. Who did his wife hug?

His wife hugged [$_F$ John].   *No R-exp in Q/Accented*

Participants were asked to read dialogues consisting of the question-answer pair, and then answer another question indicating how they interpreted the dialogue. A sample item appears in (18).

(18)   **What happened?**
         ○ John's wife hugged John.
         ○ Some other man's wife hugged John.

Twelve item sets were prepared following the pattern in (17). Using the Turktools software developed by Erlewine and Kotek (2016a), four separate lists were prepared in a Latin Square design, and participants were assigned to one of these groups and were presented the questionnaire in a uniquely randomized order. The order of answer options was counter-balanced. The experiment contained 67 fillers, which contained both grammatical and ungrammatical anaphoric relations.[9] Twenty-four participants completed the experiment using Amazon Mechanical Turk.[10]

These are the predictions. The conditions in which the R-expression appears in the question unambiguously provide a referent for the initial pronoun in the answer, and we predict (given the results of the Experiment 1) that prosody will not affect judgments for co-reference. On the other hand, in the conditions in which there is no R-expression in the question, participants have no reason to interpret the initial pronoun as co-referent with the R-expression that follows it (in fact, they may resist doing so). If, however, prosody can guide participants into accommodating the de-accented R-expression as a salient, but implicit, referent,

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[9]For instance, participants were tested on Condition C configurations, with a proportion of co-reference responses of 0.076 (SE=0.015).

[10]Two participants identified their native language as other than English. They were paid for their participation, but not included in the analysis.

they should be more likely to permit co-reference in *No R-exp in Q/De-accented* than in *No R-exp in Q/Accented*. Hence, we predict an interaction.

Results and Discussion The mean proportions of co-reference responses are shown in Figure 5. A mixed model was fit with QUESTION FORM and PROSODY as fixed factors. There were a main effect of QUESTION FORM (Est.=2.58918, SE=0.54046, z=4.791, p<0.001), a main effect of PROSODY (Est.=1.42178, SD=0.43800, z=3.246, p<0.01), and an interaction (Est.=-1.78326, SE=0.71164, z=-2.506, p<0.05). Pairwise comparison revealed that the interaction was driven by a difference between the two *No R-exp in Q* conditions (p.adj<.05). There was no significant difference between *No R-exp in Q/De-accented* and *R-exp in Q/De-accented* (p.adj>.3) and between the two *R-exp in Q* conditions (p.adj>.19).
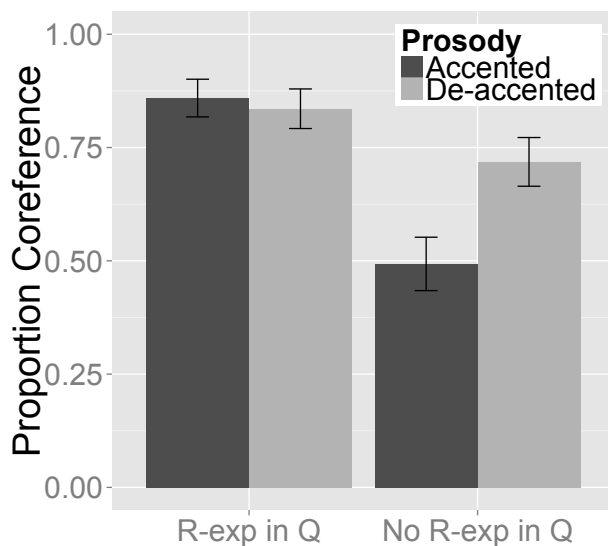

Figure 5: Mean proportion of co-reference responses (N=24) and standard error

The interaction confirms that there is no general prohibition on putting focus on an R-expression in a cataphoric dependency, replicating Experiment 1. The ef-

fect of prosody only emerges when there is no referent for the pronoun (in advance of the R-expression). In the focus cases, the choice of referent for the pronoun is essentially at chance between being co-referent or disjoint from the R-expression. However, de-accenting significantly increases the likelihood of co-reference, to levels no different from the *R-exp in Q* conditions.

Recall that Horvath suggested that, in the absence of a unique salient referent, referential expressions in cataphoric configurations induce WCO effects. We saw in Experiments 2a and 2b—where extra-linguistic reference rather than binding was possible—an effect of prosody still emerged, suggesting that WCO alone cannot account for the effect of prosody. We suggested that the focused conditions were merely ambiguous and that de-accenting was a useful heuristic in disambiguating. As for the present experiment, there are two interpretations of the lower co-reference responses in the *Accented* cases. It could be that the results might just reflect ambivalence about reference in such cases. Alternatively, in the absence of any referents (no pictures, no linguistic antecedents), participants may have resorted to semantic binding to interpret the initial pronoun in the target answer and this induced a WCO violation. The fact that the proportion of co-reference responses in *No R-exp in Q/Accented* appears to be around chance does not offer much guidance in deciding between these two interpretations, since even WCO violations are notoriously weak, as Wasow 1972 pointed out and as had been experimentally demonstrated (Pica and Snyder 1995, Kush 2013). We leave this question to further investigation.

Our results for the *De-accented* conditions are in accord with Gordon and Hendrick's Experiment 5, which found no effect of a prior reference on cataphora. We find no pairwise difference in the *De-accented* conditions, suggesting that prior mention does not further help with cataphora in this case. Even in the absence

of prior mention, though, if the R-expression is de-accented, a salient referent is prompted via the QUD, and this promotes co-reference. We might speculate that Gordon and Hendrick's materials without a question promoted an implicit prosody where the R-expression was de-accented.

6 Conclusion

The moral of the story is this: Williams and Bianchi were on to something, but they did not have the full paradigm at their disposal. So they sought to rule out the combination of focus and co-reference in (19a). Our experimental results point to a different explanation for the contrast: the ameliorating effect de-accenting has in *promoting* co-reference in (19b).

(19) a. His$_i$ mother loves JOHN$_i$.

   b. His$_i$ MOTHER loves John$_i$.

We've helped settle the facts. In contexts where multiple candidate referents are available, (19a) leaves the referent of the pronoun essentially to chance. The real action is how de-accenting ameliorates co-reference in (19b). The prosody provides a heuristic: the hearer can imagine that the referent of the R-expression is part of a QUD. Elements in the QUD are salient, and so constitute possible referents for the pronoun. As is often the case, the trouble began with not heeding the role of context, as Horvath cautioned. We have shown experimentally that with a salient referent available, (19a) is as good as (19b). What is crucial to getting the effect is to make the pronoun's reference ambiguous (Experiments 2a, 2b) or unresolvable by any direct reference (Experiment 3). Our results carry the implication that the perceived contrast in (19) is not grammatical, but merely reflects the ease with

which (19b) can be unambiguously interpreted, compared to (19a), because of the facilitating effect of de-accenting.

Our proposal is a specific implementation that belongs to a family of approaches, including Gordon and Hendrick 1998, that emphasize the role of a discourse model in conjunction with structural constraints in accounting for the acceptability of co-reference between R-expressions and pronouns. A reviewer asks whether we should seek a more general explanation, in that 'reduction'—whether through pronominalization or de-accenting—is often responsible for inviting co-reference. We would like to suggest that further research should investigate whether those observations can themselves be reduced to the interaction of the QUD, salience and co-reference relations. Future experimentation is also in order to investigate whether the pattern of results we found are replicated when more than two candidate referents are provided and whether we would expect acceptability of de-accented cataphora to be reflected in fast reading times or other on-line measures.

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