## Focus on Cataphora: Experiments in Context

*Keir Moulton*
*Queenie Chan*
*Tanie Cheng*
*Chung-hye Han*
*Kyeong-min Kim*
*Sophie Nickel-Thompson*

Since Chomsky 1976, it has been claimed that focus on a referring expression blocks coreference in a cataphoric dependency (*$\*His_i$ mother loves JOHN$_i$* vs. *His$_i$ mother LOVES John$_i$*). In three auditory experiments and a written questionnaire, we show that this fact does not hold when a referent is unambiguously established in the discourse (cf. Williams 1997, Bianchi 2009) but does hold otherwise, validating suggestions in Rochemont 1978, Horvath 1981, and Rooth 1985. The perceived effect of prosody, we argue, building on Williams's original insight and deliberate experimental manipulation of Rochemont's and Horvath's examples, is due to the fact that deaccenting the R-expression allows hearers to accommodate a salient referent via a ''question under discussion'' (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, deaccenting, 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 the answers to the questions in (1). These examples, and judgments, are from Bianchi 2009.[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 2009:5, (6)–(7))

[1] Chomsky's original examples, (ia–b), 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 1976:344)

Chomsky 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) suggests that cataphoric configurations like (1) always involve a previous discourse antecedent (possibly implicit). He claims that a focused R(eferential)-expression is at odds with this kind of anaphoricity to a discourse antecedent. Moreover, Bianchi (2009) claims that (1a) contrasts with the cases in (2), where the DPs are both either 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 2009:6, (8c))

As (2b) demonstrates, focus is possible on discourse-anaphoric R-expressions when not preceded by a pronoun (for details, see Bianchi 2009). The important feature of both Williams's and Bianchi's claims 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 response to questions like those in (1). 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* coreference in *His$_i$ wife loves JOHN$_i$*. Rather, deaccenting *promotes* coreference in *His$_i$ wife LOVES John$_i$* above the baseline expected of a fully ambiguous context. The reason for this, we argue, naturally follows from the way focus/deaccenting helps establish a "question under discussion" (Roberts 1996/2012). This has the result of making the referent of the deaccented expression salient, which in turn makes it a likely referent for the pronoun, thus promoting coreference.

## 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) present clear cases where contrastive focus on an R-expression is possible in a cataphoric configuration (3A2).

(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), they nonetheless claim that an effect of prosody on cataphora *does* arise with *bound* variable cataphoric dependencies. Rooth 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.
   (Rooth 1985:69, (59b))
   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 therefore expect that in impoverished contexts, the initial pronoun would not find a discourse antecedent or salient referent, and so would seek its interpretation via binding. Binding would involve covert movement of the referring expression (5b), which is possible since on Horvath's account the focused element raises at LF. This would 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 nonquantificational expressions like proper names can induce WCO is not implausible. While Lasnik and Stowell (1991) claim that R-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 coreference, 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 1991:697, (33))

Ruys's evidence for WCO with nonquantificational 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 2004:135, (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

---

[2] Lasnik and Stowell (1991) 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).

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 show are not borne out in our experiments: it predicts that focus on the antecedent in an impoverished context will rule out coreference. What we find, however, is that coreference is not ruled out; it is just at par with noncoreference 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 the contrast is typically viewed. It is not that focus *rules out* coreference in *His$_i$ wife loves JOHN$_i$*. Rather, deaccenting *promotes* coreference in *His$_i$ wife LOVES John$_i$* above the baseline 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 coreference and noncoreference are possible. The perceived effect comes from deaccenting 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 will 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 deaccented are shown 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 therefore 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. Therefore, in such a context we do not expect a preference for

---

[3] Rooth (1985) does not suggest that focus drives movement; rather, he suggests 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.

coreference. 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 this sentence is paired alongside its ambiguous counterpart, it appears to be the grammatical one of the two.

We report four experiments in support of the FDH. In Experiment 1, we 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 2009). 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 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 (2009).[4] Two two-level factors were crossed to create the four conditions in (10): Prosody (Accented vs. Deaccented) × DP-type (R-Expression vs. Pronoun). Bianchi predicts an interaction, such that coreference will be available in both Pronoun conditions and in the Deaccented/R-Expression condition, but not in the Accented/R-Expression condition. 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.    Accented/R-Exp
     b. Who hugged John? His wife hugged John.    Deaccented/R-Exp
     c. Who did John's wife hug? His wife hugged him.    Accented/Pron
     d. Who hugged John? His wife hugged him.    Deaccented/Pron

### 3.1 Materials, Procedures, and Participants

Sixteen sets of stimuli like (10) were created and recorded by two trained native speakers of English, one male and one female, counterbalancing the question and answer roles. The questions

---

[4] For the test trials in the deaccented condition, we chose to focus the subject DP (e.g., *wife*), not the verb as in Bianchi's (2009) original examples. We leave it for future research to determine whether predicate focus will give the same results. Also, as a reviewer points out, another factor to investigate is the effect of *own* (*His own mother loves John*), which (alongside *only* and *even*) is known to alleviate overt WCO (Postal 1993). We hope to explore this in future studies.

served to ensure that the prosody of the answer was appropriate. There were 29 fillers, which included a variety of grammatical and ungrammatical coreference relations.

The experimental task was adopted from Gordon and Hendrick 1997. Participants ($N = 31$) were first trained by the experimenter to answer whether two words highlighted in green (represented by lighter type in (10)) could be coreferential, using two clear cases of forward pronominal coreference and one clear Principle B violation.[5] In the experimental trials, participants heard the question while viewing a blank screen, then were automatically advanced to a display of the written answer paired with the audio. Below the target sentence, the following question appeared: ''Can the two parts in green refer to the same person? Yes (Y) or No (N).''

Thirty-one members of the Simon Fraser University community, all native speakers of English, were tested individually in 20-minute sessions and received either $10 or course credit.

## 3.2 Results and Discussion

The mean proportions of coreference (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
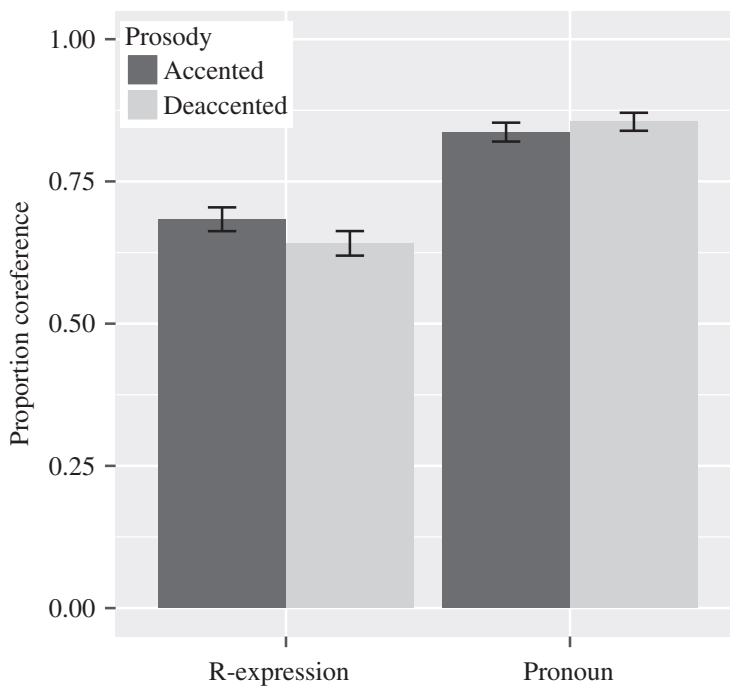


**Figure 1**
Mean proportion of coreference responses in Experiment 1 ($N = 31$) and standard error

---

[5] We chose to highlight the terms in green and not in boldface as Gordon and Hendrick (1997) did to avoid the possibility that boldface would be associated with prosodic prominence.

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 Accented/R-Exp and Deaccented/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 coreference. 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]

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 2009:347, (26))

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

(12) a. She HERSELF believes her.            77%
      b. She believes her HERSELF.            54%

The proportion of coreference 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 noncoreference responses, and in a manner that is arguably mediated by prosody. The fact that focus on the R-expression did not affect coreference 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.[7] They report much lower acceptance rates for coreference: 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 such as *$He_i$ met $John_i$'s roommate at the restaurant*. Gordon and Hendrick's 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 coreference in intraclausal cataphora increased (3.24), in comparison to acceptance rates for Condition C violations (2.43), regardless of the presence or 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

---

[6] This may be why the examples in (2) are judged better than (1a), since they do not involve cataphora in the usual sense of pronoun followed by R-expression. Bianchi's (2009) appeal to Minimize Restrictors! (Schlenker 2005) would predict this, but as noted in the text, there is no interaction with prosody.

[7] For online processing of the (biclausal) cataphora, see van Gompel and Liversedge 2003 and Kazanina et al. 2007.

difference between the manipulated conditions. Unlike Gordon and Hendrick's materials, ours were presented auditorily, which may have an ameliorating effect overall. Comparisons across experiments with different tasks and stimuli should be conducted with caution. Nevertheless, the general trend that intraclausal cataphora is more acceptable than Condition C violations is attested in both our results and Gordon and Hendrick's.

## 4 Experiment 2

Experiment 1 found no effect of prosody on cataphoric configurations in the sort of discourse that Williams (1997) and Bianchi (2009) suggest will show such an effect. The questions in the stimuli of Experiment 1 contained a salient referent for the pronoun. As Horvath (1981) and Rooth (1985) predict, coreference is permitted here in spite of focus on the R-expression. In the next two experiments, we prevented participants from easily finding a discourse referent for the pronoun by providing two possible referents in a visual display accompanied by a question-answer pair audio. Experiment 2a shows 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

*4.1.1 Materials, Procedures, and Participants*   Experiment 2a compared discourses in which the R-expression in an answer was *deaccented* or *wh-focus*. Unlike in Experiment 1, the question contained a pronoun, not an R-expression.

(13) a.  Who greeted him?
      His [$_F$ mother] greeted Benny.                               Deaccented
   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 coreference independently of the prosody of the answer. Falco (2007), building on work by 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 echo questions, as we felt that with this intonation, a WCO violation was even less acute. Experiment 2b further addresses the issue of WCO in the question.

    The design deliberately delayed participants' ability to interpret the referent of the pronouns (even those in the question) until the prosody of the final R-expression was processed. We grant that this made the dialogue more challenging for 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 observed between conditions would be telling.

    The stimuli were recorded by two trained female native speakers of English. The two speakers alternated question and answer roles.
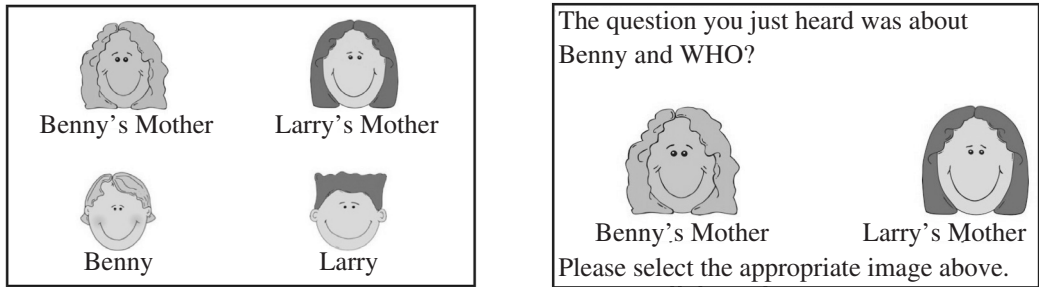
**Figure 2**
Experiment 2a, picture-based forced-choice task screens (Display 1, left; Display 2, right)

The experiment employed a picture-based forced-choice task (see figure 2). Participants (*N* = 48) were native-English-speaking members of the Simon Fraser University community and were tested individually in 20-minute sessions, receiving either $10 or course credit. Participants heard the question and the answer while viewing the first screen (Display 1), which introduced four characters and their names. In the case of (13), these were Benny, his mother, a competitor referent Larry, and his mother. After a delay of 800 milliseconds, the computer automatically advanced to the second screen (Display 2), which presented pictures of the possible referents for the subject of the target answer (Benny's mother, Larry's mother). The position of the individuals was counterbalanced in the following way: a character and his/her mother/sister/brother or relevant relation were always in the same column, but which side of the screen they were on was fully counterbalanced. Participants were asked to click on the image of the individual to answer this 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 coreferential 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 coreference. But this holds equally across experimental conditions.

As Experiment 1 demonstrated, 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, Experiment 1 showed a preference for coreference. 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 essentially at chance. However, the FDH predicts that the deaccented R-expression will promote coreference responses in comparison.

In addition to the two test conditions above, Experiment 2a included a third condition that bore broad focus on the VP (the 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 the VP-Focus condition was to tease apart whether focus marking (i.e., the *Wh*-Focus condition)

is responsible for ruling *out* coreference or whether deaccenting is responsible for ruling *in* coreference. In the VP-Focus condition, the referring expression is not deaccented, 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 deaccented conditions. On the other hand, if deaccenting alone is responsible for alleviating a disjoint reference effect, then the VP-Focus cases will pattern like the *Wh*-Focus cases. 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.[8]

*4.1.2 Results and Discussion*   The mean proportions of coreference responses are shown in figure 3. Pairwise comparison using the TukeyHSD( ) function revealed a significant difference between Deaccented and *Wh*-Focus ($p < .0001$) and Deaccented and VP-Focus ($p < .05$), but not between *Wh*-Focus and VP-Focus ($p > .05$). Unlike in Experiment 1, focus on the R-expression affects coreference responses, regardless of the type of focus.

The effect of prosody emerges when no unique, salient linguistic antecedent is given, suggesting that the effect Chomsky (1976) 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 coreference is not completely ruled out in the *Wh*-Focus condition (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 deaccenting lies in *promoting* coreference in comparison to the other conditions. Coreference responses in the Deaccented condition were greater than chance (66%; $t(23) = 3.4174, p = .002$). Coreference responses in the VP-Focus condition were no different from chance (51%; $t(23) < 0.0001, p = 1$), and those in the *Wh*-Focus condition, marginally different from chance (41.4%; $t(23) = -2.0641, p = .0505$). The slightly lower proportion of coreference responses 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

---

[8] The fillers were instances of either (ia) grammatical but biased pronominal anaphora; (ib) nonbiased, cross-clausal forward pronominal anaphora; (ic) monoclausal forward pronominal anaphora; (id) ungrammatical cataphora (Condition C violation). The mean proportion of coreference responses is reported as a percentage 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 baseline proportion of coreference responses for nonbiased, grammatical, but ambiguous forward anaphora (57%–61%).
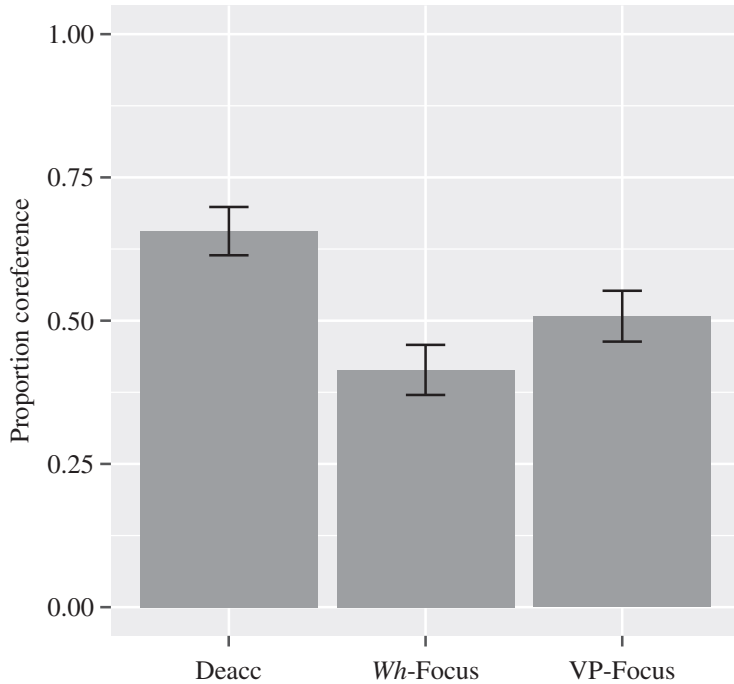
**Figure 3**
Mean proportion of coreference responses in Experiment 2a ($N = 48$) and standard error

in figure 2—participants did not need to resort to a WCO-inducing binding relation to attain coreference, and still there was an effect of prosody.[9]

Particularly instructive is the fact that the VP-Focus condition patterned statistically like the *Wh*-Focus condition. This is not expected by previous analyses of the pattern, since in these cases the R-expression is neither deaccented 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 sentence-final position). The 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 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, . . . }

---

[9] While a number of authors have argued for a theoretical principle that prefers binding over coreference (e.g., Grodzinsky and Reinhart 1993)—something that might predict WCO to discriminate against coreference even in the presented contexts—the experimental record is mixed (see Frazier and Clifton 2000, Koornneef et al. 2011, Cunnings, Patterson, and Felser 2014).

None of these alternatives reference John, so they do not evoke a QUD that 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, both referents are chosen roughly at chance (modulo whatever markedness cataphora in general invokes). Again, the generalization is not that focus blocks coreference; rather, it is that deaccenting guides reference in such ambiguous cases.

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

A reviewer asks why the Deaccented condition 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. Second, compared to unbiased forward-anaphora fillers (57%–61%), our deaccented cataphora cases fare quite well (66%). We should not expect categorical judgments in these matters, at least not in the case of intraclausal cataphora.

## 4.2  Experiment 2b

Experiment 2b was conducted to further control for a possible confound of WCO in the question in (13b), the *Wh*-Focus condition, by using the passive voice in the questions, as in (16).

*4.2.1  Materials, Procedures, and Participants*    Sixteen stimuli sets were recorded with one two-level factor, PROSODY (Deaccented vs. *Wh*-Focus).

(16)  a.  Who was he greeted by?
          His [$_F$ mother] greeted Benny.                                        Deaccented
      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.

Participants were 48 native-English-speaking members of the Simon Fraser University community, who were tested individually in 20-minute sessions and received either $10 or course credit.

*4.2.2  Results and Discussion*    The mean proportion of coreference responses for the 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. $= -0.6702$, $SE = 0.2914$, $z = -2.3$, $p < .05$).

In addition to the comparison between the VP-Focus and Deaccented conditions in Experiment 2a, the results of Experiment 2b show that the presence of a WCO violation in the stimulus
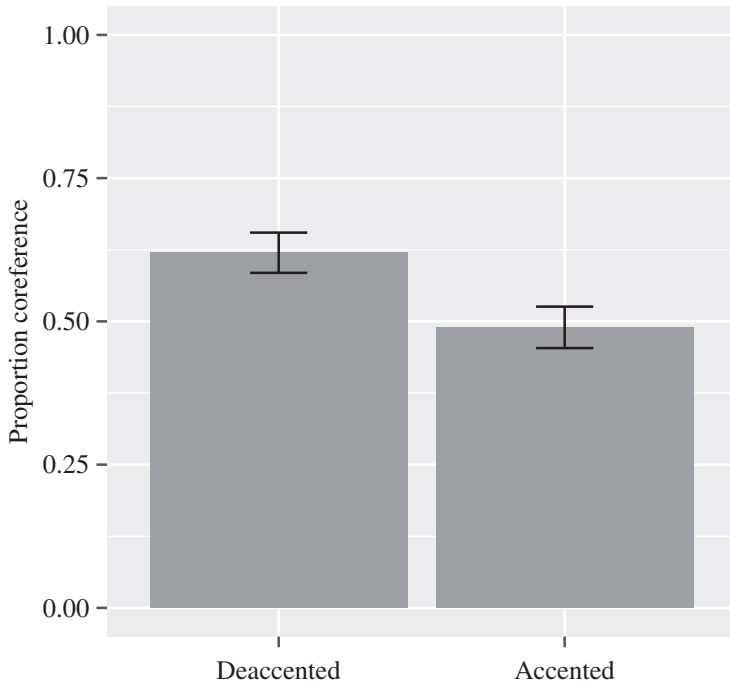
**Figure 4**
Mean proportion of coreference responses in Experiment 2b ($N = 48$) and standard error

questions cannot alone account for the difference in coreference responses that emerges as a result of 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 deaccenting guides the hearer to promote one of these two possible referents as discourse-salient via the QUD. In Experiment 3, we tested whether deaccenting can guide interpretation when no previous referents are provided—linguistically or otherwise. Furthermore, Experiment 3 solidified 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.

### 5.1 Materials, Procedures, and Participants

Two factors were crossed to create the four conditions in (17): QUESTION FORM (whether an R-expression (i.e., an antecedent) was present in the question (R-Exp in Q) or not (No R-Exp in

Q)) and PROSODY (whether the R-expression in the answer bore *wh*-focus (Accented) or not (Deaccented)).

(17) a. Who hugged John?
       His [_F wife] hugged John.                          R-Exp in Q/Deaccented
     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/Deaccented
     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 counterbalanced. The experiment included 67 fillers, which contained both grammatical and ungrammatical anaphoric relations.[10] Twenty-four participants completed the experiment using Amazon Mechanical Turk.[11]

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 Experiment 1) that prosody will not affect judgments of coreference. On the other hand, in the conditions in which no R-expression appears in the question, participants have no reason to interpret the initial pronoun as coreferential with the R-expression that follows it (in fact, they may resist doing so). If, however, prosody can guide participants into accommodating the deaccented R-expression as a salient, but implicit, referent, they should be more likely to permit coreference in the No R-Exp in Q/Deaccented condition than in the No R-Exp in Q/ Accented condition. Hence, we predict an interaction.

## 5.2 Results and Discussion

The mean proportions of coreference 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

---

[10] For instance, participants were tested on Condition C configurations, with a proportion of coreference responses of 0.076 ($SE = 0.015$).
[11] Two participants identified their native language as other than English. They were paid for their participation, but not included in the analysis.
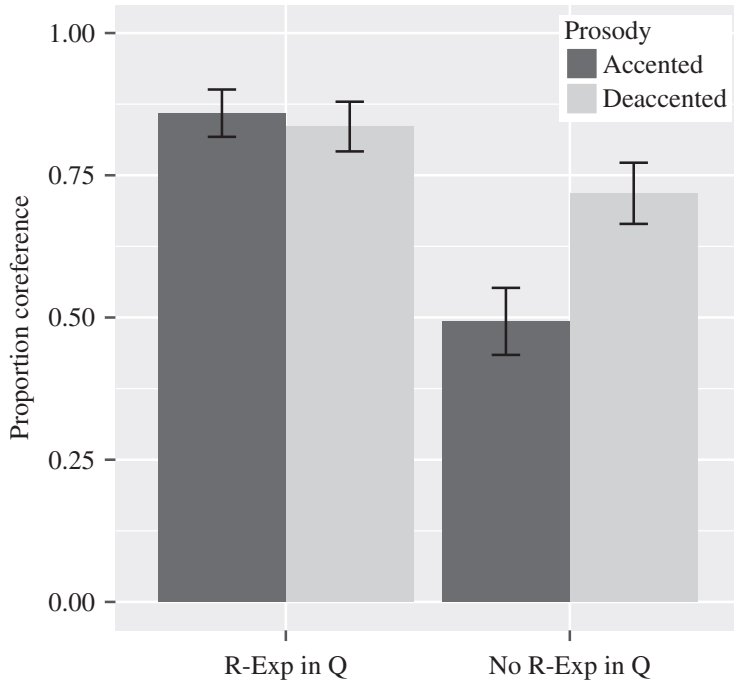
**Figure 5**
Mean proportion of coreference responses in Experiment 3 ($N = 24$) and standard error

(Est. $= 2.58918$, *SE* $= 0.54046$, $z = 4.791$, $p < .001$), a main effect of PROSODY (Est. $= 1.42178$, *SD* $= 0.43800$, $z = 3.246$, $p < .01$), and an interaction (Est. $= -1.78326$, *SE* $= 0.71164$, $z = -2.506$, $p < .05$). Pairwise comparison revealed that the interaction was driven by a difference between the two No R-Exp in Q conditions (adj. $p < .05$). There was no significant difference between the No R-Exp in Q/Deaccented condition and the R-Exp in Q/Deaccented condition (adj. $p > .3$) or between the two R-Exp in Q conditions (adj. $p > .19$).

The interaction confirms that there is no general prohibition on putting focus on an R-expression in a cataphoric dependency, replicating Experiment 1. The effect 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—whether it is coreferential with or disjoint from the R-expression—is essentially at chance. However, deaccenting significantly increases the likelihood of coreference, to levels no different from those found in the R-Exp in Q conditions.

Recall that Horvath (1981) suggests that, in the absence of a unique salient referent, referential expressions in cataphoric configurations induce WCO effects. We found in Experiments 2a and 2b—where extralinguistic reference rather than binding was possible—that 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 deaccenting was a useful heuristic in disambiguating them. As for Experiment 3, we suggest two interpretations of the lower coreference responses in the Accented cases. The results may simply 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 could have induced a WCO violation. The fact that the proportion of coreference responses in the No R-Exp in Q/Accented condition 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) points out and as has been demonstrated experimentally (Pica and Snyder 1995, Kush 2013). We leave this question to further investigation.

Our results for the Deaccented conditions are in accord with Gordon and Hendrick's (1997) Experiment 5, which found no effect of a prior reference on cataphora. We found no pairwise difference in the Deaccented 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 deaccented, a salient referent is prompted via the QUD, and this promotes coreference. We might speculate that Gordon and Hendrick's materials without a question promoted an implicit prosody where the R-expression was deaccented.

## 6 Conclusion

The moral of the story is this: Williams (1997) and Bianchi (2009) were onto something, but they did not have the full paradigm at their disposal, so they sought to rule out the combination of focus and coreference in (19a). Our experimental results point to a different explanation for the contrast: the ameliorating effect deaccenting has in *promoting* coreference in (19b).

(19) a. His$_i$ mother loves JOHN$_i$.
     b. His$_i$ MOTHER loves John$_i$.

We have 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 deaccenting ameliorates coreference 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 imply 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 deaccenting.

Our proposal is a specific implementation that belongs to a family of approaches, including Gordon and Hendrick's (1998), that emphasize the role of a discourse model in conjunction with structural constraints in accounting for the acceptability of coreference between R-expressions and pronouns. A reviewer asks whether we should seek a more general explanation, in that

''reduction''—whether through pronominalization or through deaccenting—is often responsible for inviting coreference. We suggest that further research should investigate whether those observations can themselves be reduced to the interaction of the QUD, salience, and coreference relations. Future experimentation is also in order to investigate whether the pattern of results we found is replicated when more than two candidate referents are provided and whether acceptability of deaccented cataphora is reflected in fast reading times or other online measures.

## References

Bianchi, Valentina. 2009. A note on backward anaphora. *Rivista di Grammatica Generativa* 34:3–34.

Büring, Daniel. 2005. *Binding theory.* Cambridge: Cambridge University Press.

Chomsky, Noam. 1976. Conditions on rules of grammar. *Linguistic Analysis* 2:303–351.

Cunnings, Ian, Clare Patterson, and Claudia Felser. 2014. Variable binding and coreference in sentence comprehension: Evidence from eye movements. *Journal of Memory and Language* 71:39–56.

Erlewine, Michael Yoshitaka, and Hadas Kotek. 2016a. A streamlined approach to online linguistic surveys. *Natural Language and Linguistic Theory* 34:481–495.

Erlewine, Michael Yoshitaka, and Hadas Kotek. 2016b. Tanglewood untangled. In *Proceedings of SALT 26*, ed. by Mary Moroney, Carol-Rose Little, Jacob Collard, and Dan Burgdorf, 224–243. Available at http://journals.linguisticsociety/proceedings/index.php/SALT/issue/view/154.

Falco, Michelangelo. 2007. Weak crossover, specificity and LF chains. In *Coreference, modality, and focus*, ed. by Luis Eguren and Olga Fernández-Soriano, 19–44. Amsterdam: John Benjamins.

Fiengo, Robert, and Robert May. 1994. *Indices and identity.* Cambridge, MA: MIT Press.

Frazier, Lyn, and Charles Clifton, Jr. 2000. On bound variable interpretations: The LF-only hypothesis. *Journal of Psycholinguistic Research* 29:125–139.

van Gompel, Roger P. G, and Simon P. Liversedge. 2003. The influence of morphological information on cataphoric pronoun assignment. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 1:128–139.

Gordon, Peter C., and Randall Hendrick. 1997. Intuitive knowledge of linguistic co-reference. *Cognition* 62:325–370.

Gordon, Peter C., and Randall Hendrick. 1998. The representation and processing of coreference in discourse. *Cognitive Science* 22:389–424.

Grodzinsky, Yosef, and Tanya Reinhart. 1993. The innateness of binding and coreference. *Linguistic Inquiry* 24:69–102.

Heim, Irene. 2009. Forks in the road to Rule I. In *NELS 38*, ed. by Muhammad Abdurrahman, Anisa Schardl, and Martin Walkow, 339–358. Amherst: University of Massachusetts, Graduate Linguistic Student Association.

Horvath, Julia. 1981. Aspects of Hungarian syntax and the theory of grammar. Doctoral dissertation, UCLA, Los Angeles, CA.

Horvath, Julia, and Michael Rochemont. 1986. Pronouns in discourse and sentence grammar. *Linguistic Inquiry* 17:759–766.

Kazanina, Nina, Ellen F. Lau, Moti Lieberman, Masaya Yoshida, and Colin Phillips. 2007. The effect of syntactic constraints on the processing of backwards anaphora. *Journal of Memory and Language* 56:384–409.

Koornneef, Arnout W., Sergey Avrutin, Frank Wijnen, and Eric Reuland, 2011. Tracking the preference for bound-variable dependencies in ambiguous ellipses and *only*-structures. In *Experiments at the interfaces*, ed. by Jeffrey T. Runner, 67–100. Leiden: Brill.

Krifka, Manfred. 2006. Association with focus phrases. In *The architecture of focus*, ed. by Valéria Molnár and Susanne Winkler, 105–136. New York: Mouton de Gruyter.

Kush, Dave. 2013. Respecting relations: Memory access and antecedent retrieval in incremental sentence processing. Doctoral dissertation, University of Maryland, College Park.

Lasnik, Howard, and Tim Stowell. 1991. Weakest crossover. *Linguistic Inquiry* 22:687–720.

Pesetsky, David. 1987. *Wh*-in-situ: Movement and unselective binding. In *The representation of (in)definiteness*, ed. by Eric J. Reuland and Alice G. B. ter Meulen, 98–129. Cambridge, MA: MIT Press.

Pica, Pierre, and William Snyder. 1995. Weak crossover, scope, and agreement in a minimalist framework. In *WCCFL 13*, ed. by Raul Aranovich, William Bryne, Susanne Preuss, and Martha Senturia, 334–349. Stanford, CA: CSLI Publications.

Postal, Paul M. 1993. Remarks on weak crossover effects. *Linguistic Inquiry* 24:539–556.

Reinhart, Tanya. 1983. *Anaphora and semantic interpretation.* Chicago: University of Chicago Press.

Roberts, Craige. 1996/2012. Information structure in discourse: Towards an integrated formal theory of pragmatics. *Semantics and Pragmatics* 5:1–69.

Rochemont, Michael. 1978. A theory of stylistic rules in English. Doctoral dissertation, University of Massachusetts, Amherst.

Rooth, Mats. 1985. Association with focus. Doctoral dissertation, University of Massachusetts, Amherst.

Rooth, Mats. 1996. Focus. In *The handbook of contemporary semantic theory*, ed. by Shalom Lappin, 271–297. London: Blackwell.

Ruys, E. G. 2004. A note on weakest crossover. *Linguistic Inquiry* 35:124–140.

Schlenker, Philippe. 2005. Minimize Restrictors! (Notes on definite descriptions, Condition C and epithets). In *Proceedings of SuB 9*, ed. by Emar Maier, Corien Bary, and Janneke Huitink, 385–416. Nijmegen: Nijmegen Centre of Semantics.

Tomioka, Satoshi. 1996. On the mismatch between variable binding and sloppy identity. In *WCCFL 14*, ed. by José Camacho, Lina Choueiri, and Maki Watanabe, 541–556. Stanford, CA: CSLI Publications.

Wagner, Michael. 2006. Association by movement: Evidence from NPI-licensing. *Natural Language Semantics* 14:297–324.

Wasow, Thomas. 1972. Anaphoric relations in English. Doctoral dissertation, MIT, Cambridge, MA.

Williams, Edwin. 1997. Blocking and anaphora. *Linguistic Inquiry* 28:577–628.

*Department of Linguistics*
*Simon Fraser University*
*8888 University Drive*
*Burnaby, British Columbia V5A 1S6*
*Canada*

*kmoulton@sfu.ca*
*qchan@sfu.ca*
*taniec@sfu.ca*
*chunghye@sfu.ca*
*kyeongmin_kim@sfu.ca*
*s.nickel.thompson@gmail.com*