Locative Inversion, PP Topicalization, and Weak Crossover in English*

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Abstract

The literature on locative inversion in English currently disputes whether locative inversion differs from PP topicalization in permitting a quantifier in the fronted PP to bind a pronoun in the subject. In order to resolve this dispute, this paper runs two experiments on Amazon Mechanical Turk, one an acceptability judgment task and the other a forced-choice task. Both find that PP topicalization does not differ from locative inversion: both permit variable binding. Locative inversion also does not differ from a minimally different sentence with the overt expletive *there*. These findings remove an argument against the null expletive analysis of English locative inversion (Lawler 1977, Postal 1977, 2004, Bruening 2010), and they also show that weak crossover is not uniformly triggered by A-bar movement.

1   Introduction

A major point of contention in the literature on English locative inversion, exemplified in (1), is the question of what the subject in Spec-TP is.

(1)   Under the bridge lived a bloodthirsty troll.

There are basically two schools of thought. One holds that the fronted PP is the subject in Spec-TP (although most analyses add that it subsequently extracts to an A-bar position). The other school of thought holds that a null expletive like *there* is the subject in Spec-TP. Among those who argue that the PP is the subject are Bresnan (1994), Culicover & Levine (2001), Doggett (2004), Diercks (2017), while those arguing for a null expletive include Lawler (1977), Postal (1977, 2004), Bruening (2010).

Diercks (2017), summarizing the arguments (and see that work for additional references), asserts that the crucial set of facts deciding in favor of the PP-as-subject analysis involves weak crossover (WCO). Culicover & Levine (2001) claimed that locative inversion contrasts with PP topicalization in that only the former permits a quantifier in the fronted PP to bind a pronoun as a variable in the NP that agrees with the verb. Topicalizing a PP over a preverbal subject is claimed to result in weak crossover:

*Thanks to Amanda Payne, for running the experiments on Mechanical Turk.

(2) a. * In every dog$_1$'s cage its$_1$ collar hung. (topicalization, WCO)

  b. In every dog$_1$'s cage hung its$_1$ collar. (locative inversion, no WCO)

According to Doggett (2004), with an overt expletive the fronted PP patterns with topicalization, not locative inversion:

(3) * In every dog$_1$'s cage there hung its$_1$ collar.

These researchers take this to show that only in locative inversion does the PP occupy an A-position high in the clause, on the assumption that variable binding requires binding from an A-position, while A-bar movement always gives rise to weak crossover. This then supports the PP-as-subject analysis and argues against the null expletive analysis, since locative inversion is patterning differently from a comparable sentence with an overt expletive.

  The judgment in (3) was disputed by Postal (2004) and Bruening (2010), who argue that any degradation in (3) is due to the definiteness effect with overt *there* rather than to the failure of variable binding. Diercks (2017), however, dismisses this claim, disagreeing with Postal's and Bruening's judgments on variant items.

  Complicating the empirical picture further, I and other native speakers I have asked actually find variable binding acceptable in topicalization examples like (2a). Adding an additional modifier at the end makes the sentence more natural but should not affect crucial aspects of the structure:

(4) In every dog$_1$'s cage, its$_1$ collar hung from a hook welded to the bars.

In agreement with this judgment, Pica & Snyder (1995) judge topicalization of NP quantifiers to permit variable binding, contradicting Postal (1993).

  Given this dispute over judgments, it is important to ascertain what the empirical facts are using a method other than the introspective judgments of professional linguists who have a stake in the outcome. To this end I ran two large-scale acceptability studies on naive English speakers using the Amazon Mechanical Turk tool (see Gibson et al. 2011, Sprouse 2011). The first compares acceptability judgments on variable binding with locative inversion versus PP topicalization, as in (2). The second directly compares locative inversion and PP topicalization with the expletive *there*, as in (2b) versus (3). This experiment used a forced-choice task rather than an acceptability task. The results show that naive English speakers do not distinguish topicalization from locative inversion for variable binding, and they do not distinguish locative inversion from sentences with *there*. This removes one of the arguments for the PP-as-subject analysis of locative inversion, and illustrates another way in which locative inversion patterns with *there*-sentences, as I discuss in the conclusion. It also shows that weak crossover is not about A- versus A-bar movement. The conclusion also discusses the nature of weak crossover, where I suggest that Eilam (2011) is correct that weak crossover is about information structure, not A-bar movement.

2 Experiment 1: Locative Inversion Versus PP Topicalization

Experiment 1 compared locative inversion and PP topicalization on the ability of a quantifier in the fronted PP to bind a pronoun in the NP that agrees with the verb.

2.1 Items

Minimal triplets were constructed like the following:

(5) a. Base: Her lady in waiting stood to the left of every princess with an extra cape.

b. Top: To the left of every princess, her lady in waiting stood with an extra cape.

c. LocInv: To the left of every princess stood her lady in waiting with an extra cape.

All variants included an additional modifier, because modifiers were judged to make the sentences more natural, as mentioned above. Gendered quantified noun phrases were chosen so that there would be no question of the suitability of the pronoun covarying with the quantifier.

The task was a simple judgment of acceptability. Gordon & Hendrick (1997) showed that subjects rate sentences lower in acceptability if they cannot resolve the referent of a pronoun. The logic of Experiment 1 is that, if binding of the pronoun *her* by the quantifier is unacceptable in any of (5a–c), then that pronoun will lack a referent, and subjects will rate it lower in acceptability. Note that this does *not* mean that subjects find such sentences unacceptable. All of these sentences have a perfectly acceptable reading where the pronoun refers to some individual not named in the sentence. What Gordon & Hendrick (1997) showed was that, if a sentence presented out of the blue has a pronoun with no referent available in that sentence, then they rate the sentence lower in acceptability. In addition, Kush et al. (2017) used acceptability judgments in experiments involving strong and weak crossover with wh-questions, and showed that subjects do indeed rate sentences that violate weak crossover lower than sentences that do not. This task should then be a valid comparison of the three sentences in (5).

The Base sentence without fronting of the PP was included as a comparison. In the Base sentence in (5a), the pronoun is neither c-commanded nor preceded by the quantifier. Subjects are expected not to permit the bound variable interpretation and to only allow a referential reading. On this reading the pronoun is not provided with a referent in the presented sentence, and so we expect, given the findings of Gordon & Hendrick (1997) and Kush et al. (2017), that they will rate it lower. We can then compare Top and LocInv examples like those in (5b–c) to the Base condition. If Culicover & Levine (2001), Doggett (2004), Diercks (2017) are correct and topicalization and locative inversion differ in their ability to support a bound variable reading, then Top and LocInv items should be rated differently by the participants in this experiment. Specifically, Top should pattern with Base and be rated lower than LocInv.

A further check of the logic of the task was provided by an additional pair, as follows:

(6) a. Var: Every princess hopes that her lady in waiting will be nice.

b. NoVar: Her lady in waiting hopes that every princess will be nice.

In the Base sentence in (5a), it might be possible for the PP to take scope over the subject, leading to higher than expected judgments of acceptability. In (6b), in contrast, the theoretical literature is in general agreement that the quantifier should be unable to take scope over the matrix pronoun across a finite clause boundary (or should be able to only with great difficulty). The Var item in (6a), in contrast, should easily allow a bound variable reading. The Var and NoVar items then provide a check on the experiment: If the subjects are performing as expected, judgments of acceptability on the Var items should be significantly higher than those on the NoVar items, since in Var (6a), subjects can resolve the referent of the pronoun internal to the sentence, but in NoVar (6b), they

cannot (it has to refer to an entity not named in the sentence). If this is indeed the finding, then the logic of the task is confirmed and we can legitimately compare the Base, Top, and LocInv items in (5).

Note that absolute values of the acceptability judgments are meaningless and nothing will be made of them; all we can do is compare judgments on minimally different items to see if they are being treated differently. In the present experiment, the crucial comparison is between Top and LocInv (5b vs. 5c), and their comparison to Base (5a). Since Var/NoVar are not minimally different from the set of Base/Top/LocInv, no comparison across these will be attempted. All of these items are also expected to be judged to be acceptable, so it is the comparisons that are relevant, not the absolute values (low versus high, or positive versus negative z-scores, for instance).

Nine sets like those in (5) were constructed and divided into three lists so that no subject saw more than one item from each set of the triplet in (5). The Var and NoVar items in (6) were divided among the three lists so that no subject saw both members of any pair. The complete list of items appears in the appendix. Each list included three exemplars of each condition, for a total of 15 experimental items. Each list also included 33 filler items. 16 of these were items for an unrelated experiment involving adverb placement. None of these items involved quantifiers or pronouns, and they had very different syntactic structures, so they effectively served as distractor items. The other 17 fillers were simply fillers, six of which were acceptable and six of which were unacceptable, with the other five somewhere in between. The task was to rate how acceptable each sentence was on a scale of 1 to 7, 1 being "completely unacceptable" and 7 being "completely acceptable."

2.2   Subjects

82 subjects were recruited using Amazon Mechanical Turk, limited to people with IP addresses in the United States. All reported being native speakers of English. Two of the subjects were thrown out because they gave the same rating of acceptability to all of the sentences and were therefore clearly not engaged in the task. This left 80 subjects whose data entered the analysis. All 80 gave judgments on the filler items in the expected pattern. Because the age of the speakers was important to the unrelated study involving adverbs, all of the subjects were over 40 years old. There is no reason to think that judgments on variable binding should differ by age, so this should not be an issue. The average age was 46. 40% identified as female, 60% as male. Subjects were paid 50 cents for their participation. The entire experiment typically took subjects about six minutes to complete.

2.3   Results

The results of Experiment 1 are shown in Table 1 (raw and z-scores, mean and standard deviation). Statistical analysis was run using R (R Core Team 2012). Z-scores were analyzed by means of linear mixed-effect modeling using the R-package lme4. In the model, Condition was a fixed effect and subjects and items were included as random intercepts (a full model with random slopes as well as intercepts did not converge). Reported p-values were extracted from the fitted model objects using the Satterthwaite approximation implemented by the lmerTest package. Pairwise comparisons were conducted using the difflsmeans() function in lmerTest.

Two different analyses were performed. One included all five conditions in a single model, whereas the second separated Base-Top-LocInv from Var-NoVar into two separate models. In

Table 1: Results of Experiment 1

Condition	Raw Mean	Raw SD	Z-Score Mean	Z-Score SD
Base (Her lady in waiting stood to the left of every princess with an extra cape.)	3.63	1.82	-0.53	0.88
Top (To the left of every princess, her lady in waiting stood with an extra cape.)	5.32	1.53	0.32	0.75
LocInv (To the left of every princess stood her lady in waiting with an extra cape.)	5.56	1.40	0.43	0.71
Var (Every princess hopes that her lady in waiting will be nice.)	5.80	1.13	0.58	0.56
NoVar (Her lady in waiting hopes that every princess will be nice.)	5.02	1.70	0.18	0.83

the single model, pairwise comparisons indicate that LocInv is significantly different from Base (df=40, t=–13.1210, p<.001) and Top is significantly different from Base (df=40, t=–11.5418, p<.001), but LocInv and Top are not significantly different from each other (df=40, t=1.5793, p=0.1221416). Var and NoVar are also significantly different from each other (df=40, t=–5.3831, p<.001), as expected. The same finding holds in the other analysis, with two separate models: Pairwise comparisons indicate that LocInv is significantly different from Base (df=23.9, t=–12.530, p<.001), Top is significantly different from Base (df=23.9, t=–10.967, p<.001), but LocInv and Top are not significantly different from each other (df=23.9, t=1.563, p=0.1312). In the model comparing Var with NoVar, the difference between the two is also significant (df=15.6, t=–5.9276, p<.001). As stated above, comparisons between Var/NoVar and any of Base, Top, LocInv are meaningless because they are not minimal pairs (but see the Discussion below).

2.4 Discussion

The results of Experiment 1 are telling in at least two respects. First, the difference between Var and NoVar confirms that the logic of the experiment is sound, and that participants are behaving as expected. They rate sentences lower where no bound variable interpretation is possible for a pronoun and there is no other sentence-internal referent for that pronoun (the NoVar condition), compared to a sentence where a bound pronoun interpretation is possible (the Var condition).

Second, Experiment 1 found that subjects do not distinguish PP topicalization from locative inversion in the ability of a quantifier in the fronted PP to bind a pronoun in the NP that agrees with the verb. A quantifier in a topicalized PP can bind a pronoun inside the agreeing NP as a variable, just as well as a quantifier inside the fronted PP in locative inversion can. This contradicts the judgments reported by Culicover & Levine (2001), Doggett (2004), Diercks (2017). However, it is in line with the judgments of this author and Pica & Snyder (1995). I conclude that naive speakers of English do not distinguish PP topicalization from locative inversion in variable binding, at least as far as can be determined from a simple judgment of acceptability.

Before moving to Experiment 2, which directly compares locative inversion with PP topicalization plus an overt *there*, one might wonder at the large difference in acceptability evident in Experiment 1 between the Base and NoVar conditions. Both of these are assumed to not permit

variable binding, and so both were expected to be rated lower than the other sentences. This was indeed the finding, but Base was rated even lower than NoVar (Base had a negative z-score, while NoVar had a positive one). As stated above, since Base and NoVar are not minimal pairs, we cannot really compare them. I speculate that if there is a difference, it is due to the presence of the clause boundary in NoVar. One possibility is that subjects wait until a clause boundary before committing to an analysis of a pronoun. In NoVar, no referent for the pronoun appears before the clause boundary, and so subjects might commit to a referential reading, where the pronoun refers to some discourse referent that has to be accommodated. In NoVar, in contrast, subjects encounter a quantifier that is a potential antecedent for the pronoun before they reach a clause boundary. They have to evaluate whether the quantifier is a potential antecedent for the pronoun, meaning that they have to evaluate whether the quantifier can take scope over and bind the pronoun. This might be a more difficult task, leading to lower ratings of acceptability, whereas in NoVar the only degradation is due to having to accommodate an unavailable discourse referent. Of course, this is pure speculation, and further research would be needed to confirm whether it is on the right track, or whether there is indeed any significant difference between monoclausal items like Base and (minimally different) biclausal items like NoVar.

3 Experiment 2: Locative Inversion Versus an Overt Expletive

Experiment 1 found that PP topicalization and locative inversion do not differ in variable binding, contradicting Culicover & Levine (2001), Doggett (2004), Diercks (2017). Since the dispute in the literature on locative inversion is about sentences that differ only in the presence of an overt expletive *there*, Experiment 2 compared those directly. However, because sentences with *there* are degraded with definite postverbal NPs, including possessed ones, an acceptability judgment task was not appropriate. Sentences with *there* would probably be rated lower for a reason other than the availability of variable binding. Experiment 2 therefore used a forced-choice judgment on the antecedent of the pronoun rather than a judgment of acceptability.

Experiment 2 used a paradigm modified from Bruening & Al Khalaf (2019). Bruening & Al Khalaf (2019) used a forced-choice task to probe Binding Condition C. The logic of the task is that if there is a grammatical difference between two items in what can serve as the antecedent for a pronoun, then we should see this difference reflected in fewer choices of the restricted antecedent. To give an example, Bruening & Al Khalaf (2019) used this method to test Binding Condition C in English in examples like the following:

(7) a. The policeman said that near him, Dan saw a snake.
      Who was the snake near to? A: the policeman B: Dan
    b. The policeman said that near Dan, he saw a snake.
      Who saw the snake? A: the policeman B: Dan

According to Reinhart (1976), the pronoun in (7a) can refer to *Dan*, but in (7b), it cannot. In both, it can refer to *the policeman*. Bruening & Al Khalaf (2019) confirmed this experimentally: Participants presented with the sentence and the two-choice question in (7a) chose *Dan* as the referent of the pronoun 50.7% of the time, whereas in (7b), they chose *Dan* only 8.6% of the time. Bruening & Al Khalaf (2019) interpreted this to show that there is indeed a grammatical constraint ruling out *Dan* as the antecedent for the pronoun in (7b), otherwise participants would have chosen

that answer approximately 50% of the time again. Note that this finding also rules out a recency explanation for pronoun resolution: In (7a), the most recently mentioned NP prior to the pronoun is *the policeman*, but this NP is chosen only 49.3% of the time. Conversely, in (7b), the most recent NP is *Dan*, but this antecedent is almost never chosen. This latter finding shows that there is a grammatical constraint against coreference between *Dan* and *he* in (7b). Note furthermore that this simple forced-choice task, with only two possible choices, was shown to yield the same results as tasks with multiple choices used in experiments by Adger et al. (2016) and Wierzba et al. (to appear). Specifically, adding a third choice like "either" would not have yielded any additional information, and it would only have decreased statistical power.

Experiment 2 modifies this task to use it with a quantificational NP in a fronted PP.

3.1   Items

Items were constructed in triplets like the following, with a forced-choice question that would go with each item in the triplet:

(8)   Paradigm for Experiment 2
    a.   There: The old king said that beside every knight there stood his squire.
    b.   LocInv: The old king said that beside every knight stood his squire.
    c.   Base: The old king said that his squire stood beside every knight.
        Question for all three: Whose squire is it? A: the old king's B: every knight's

The two possible answers to the question were the matrix subject and a quantificational phrase in a PP in the embedded clause. The clauses of interest (those with the fronted PP) were always embedded under a verb like *say* or *think* that permits locative inversion and PP topicalization in its complement. The purpose of this was to provide a second possible referent for the pronoun, in the form of the matrix subject.

The logic of this task follows that of the experiments in Bruening & Al Khalaf (2019): If the There and LocInv conditions differ in the possibility of variable binding, we should see this difference reflected in fewer choices of the quantificational antecedent in the There condition (i.e., fewer choices of *every knight*). If A-bar movement like topicalization never enables variable binding, we ought to expect to see the There condition patterning with the Base condition. However, there could be extragrammatical reasons why those two might differ (preferences or processing heuristics based on linear order, for example). The crucial comparison is the There-LocInv one. If there is a grammatical difference in variable binding, as Doggett (2004) and Diercks (2017) claim, responses to these two conditions should differ. On the other hand, if there is no difference in variable binding between the There and LocInv conditions, as proponents of the null expletive analysis of locative inversion assert (Postal 2004, Bruening 2010), and as we might expect given the results of Experiment 1, then responses to these two conditions should *not* differ.

Note that the definiteness restriction is violated in the There condition, but this was judged to only make the sentences slightly awkward, not unacceptable. Subjects should be able to answer the forced-choice question even if they find the There condition degraded compared to the LocInv condition. Speakers are assumed to be able to use their grammar to compute antecedent-pronoun relations, and variable binding relations, even if a sentence is not fully acceptable (so long as the structural conditions on antecedence are met).

Six sets like those in (8) were constructed and divided into three lists so that no subject saw more than one item from each set. The complete list of items appears in the appendix. Each list included two exemplars of each condition, for a total of six experimental items per subject. Each list also included twelve filler items. Six of these were items for an unrelated experiment, also involving adverb placement. None of these items had PP fronting or involved quantifiers, so they effectively served as distractor items. The other six were simply fillers. This time subjects were instructed to answer different questions for each item. The items for this experiment asked for the referent of the pronoun, as did two of the fillers (where one choice should have been excluded by Binding Condition C, and subjects did indeed never select that choice). The items for the unrelated adverb experiment asked subjects to rate how acceptable each sentence was on a scale of 1 to 7, 1 being "completely unacceptable" and 7 being "completely acceptable." Four of the fillers also asked subjects to rate acceptability. Subjects were expected to find one of these acceptable, and three unacceptable.

3.2 Subjects

Once again, 80 subjects were recruited using Amazon Mechanical Turk, limited to people with IP addresses in the United States. All reported being native speakers of English. None of the subjects were thrown out, as they all answered as expected on the filler items. Because the age of the speakers was important to the unrelated study involving adverbs again, all of the subjects were over 40 years old. There is no reason to think that judgments on variable binding should differ by age, so this should not be an issue. The average age was 45.65. 33.75% identified as female, 62.5% as male (the others did not answer). Subjects were paid 60 cents for their participation.

3.3 Results

Results are shown in Table 2. Table 2 shows for each condition the percentage of answers where the quantifier is chosen as the antecedent for the pronoun.

Table 2: Results of Experiment 2

Condition	Quantifier %
There (The old king said that beside every knight there stood his squire.)	83.125
LocInv (The old king said that beside every knight stood his squire.)	75.0
Base (The old king said that his squire stood beside every knight.)	21.25

As can be seen, subjects choose the quantifier as antecedent very rarely in the Base condition, as would be expected. In contrast, in both the There and LocInv sentences, they choose the quantifier as antecedent most of the time. They actually do so more in the There condition than in the LocInv condition, contrary to what Doggett (2004) and Diercks (2017) would expect.

Statistical analysis was run using R (R Core Team 2012). Results were analyzed by means of linear mixed-effect modeling using the R-package lme4. In the model, Condition was a fixed effect and subjects and items were included as random intercepts (a full effects model with random slopes failed to converge). Since the task was a two-choice one, glmer with family binomial was used rather than lmer. Reported p-values were extracted from the fitted model objects using a

Tukey's post-hoc test implemented with the glht function from the multcomp package. Pairwise comparisons indicate that LocInv is significantly different from Base (z=6.841, p<.001) and There is significantly different from Base (z=7.692, p<.001), but LocInv and There are not significantly different from each other (z=1.378, p=0.351).

3.4 Discussion

It is clear that judgments from naive English speakers do not accord with the judgments reported by Doggett (2004) and Diercks (2017). There is no difference between locative inversion and sentences with a fronted PP and overt *there* in the ability of a quantifier inside the fronted PP to bind a variable in the agreeing NP. If there were a grammatical constraint against a fronted quantifier binding a pronoun in sentences with *there*, we should not have seen subjects choosing this option in Experiment 2. In fact they did, at the same rate or greater than in sentences with locative inversion.[1] This is in line with the judgments reported by proponents of the null expletive analysis of locative inversion (Postal 2004, Bruening 2010). Experiment 2 is also consistent with Experiment 1 in that subjects in both experiments treat fronted PPs identically regardless of whether the agreeing NP is preverbal or postverbal. In both experiments, quantifiers in topicalized PPs could bind pronouns as variables. This means that topicalizing a PP apparently does not give rise to weak crossover in English.

4 Overall Discussion and Conclusion

In this investigation, experiments conducted on naive English speakers using two different tasks reached the same conclusion: PP topicalization does not give rise to weak crossover in English. A quantifier in a topicalized PP can bind a pronoun in the subject as a variable. This is true whether the subject is preverbal or postverbal. Importantly for the debate regarding locative inversion, locative inversion sentences do not pattern differently from sentences with an overt expletive *there* as subject. This contradicts judgements reported by Culicover & Levine (2001), Doggett (2004), Diercks (2017), but agrees with judgments reported by Postal (2004) and Bruening (2010).

4.1 The Analysis of English Locative Inversion

This finding removes one of the arguments in favor of the PP-as-subject analysis of locative inversion, and argues in favor of the expletive subject analysis, since variable binding is yet another way in which locative inversion patterns with sentences with an overt *there*. For a long list of ways in which they pattern the same, see Postal (2004), Bruening (2010), and also Bruening (2016), where locative inversion and *there* sentences pattern together but behave differently from quotative inversion sentences for a number of grammatical phenomena. To give one example, in tag questions with locative inversion, the tag is *there*:

(9) To Gloria will fall a number of important tasks, won't there? (Postal 2004: 42, (92b))

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[1]A reviewer asks why participants did not choose the quantificational antecedent 100% of the time. This is because the matrix subject provides another possible antecedent. We have to expect that subjects will choose this other antecedent on at least some proportion of trials, given that it is a legitimate one. Participants do choose the quantifier on the majority of trials, presumably because it is the closest and therefore most accessible antecedent.

9

There in the tag could not be a pronominal for the fronted PP, because *there* is not an appropriate pronoun for this PP:

(10)   That task fell [to Gloria], but it shouldn't have fallen *there/to her. (Postal 2004: 42, (92a))

There in the tag must instead correspond to a null expletive *there* in the locative inversion clause.

The findings of this paper are then most compatible with the null expletive analysis, which posits a null *there* in Spec-TP of locative inversion clauses:

(11)   To Gloria [TP ~~there~~ will fall a number of important tasks], won't there?

The PP never occupies Spec-TP in this analysis, rather, it is in topicalized position (assumed to be Spec-CP). For a detailed exposition and defense of this analysis, see Bruening (2010).[2]

4.2   Disputes over Data

This study also joins a growing list of cases where judgments from some professional linguists have diverged from those of the population at large. For one case involving reconstruction for Binding Principle C, see Adger et al. (2016) and Bruening & Al Khalaf (2019). Other cases include multiple questions (Clifton et al. 2006), adjectival passives of raising to object verbs (Bruening 2014), and nominalizations of raising verbs (raising to subject and raising to object; see Bruening 2018). It is becoming increasingly important for linguists to support any judgments that they report in their work using multiple sources of evidence, such as corpus evidence and survey results. It should no longer be acceptable practice for one linguist to simply assert that the judgments of another are faulty; it is incumbent upon anyone who cares about the validity of data to ascertain what the facts actually are using every available source of data.

Of course, this raises the question of why some professional linguists disagree about the data. One possibility is that there are actually two grammars, with some speakers permitting variable binding from a topicalized PP, and others not. The two camps of professional linguists would differ in their grammars. To examine this possibility, I further analyzed the data from Experiment 2. Seven participants out of 80 did not choose the quantificational antecedent for the pronoun on either of the two There sentences they saw. It is possible that these seven rule out variable binding from a fronted PP in sentences with an overt *there*. Of these seven, four did answer with the quantificational antecedent on at least one of the LocInv sentences. This means that four out of 80 subjects show the pattern published by Doggett (2004) and Diercks (2017). If there is such a grammar, then, it belongs to a tiny minority: only five percent of English speakers have this grammar (assuming the participants of Experiment 2 are representative).

Another possibility is that the acceptability of variable binding is related not to the A- versus A-bar status of the fronted PP, but to information structure. It is possible that the speakers who do not like variable binding with an overt *there* have a harder time constructing the relevant information structure for the clause. I discuss this possibility next.

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[2]The proper analysis of English locative inversion has implications beyond one corner of English syntax. To take one example from the literature, Landau (2010) proposes that certain experiencer verbs have a structure like locative inversion, where there is a PP in subject position. If this is the wrong analysis of locative inversion, Landau's proposal is undermined as it lacks its purported analogical basis.

4.3 The Nature of Weak Crossover

The standard analysis of weak crossover treats it as arising from A-bar movement (for an overview, see Safir 2017). In the standard treatment, a quantificational element can only bind a pronoun as a variable from its highest A-position. If it crosses a pronoun by A-bar movement, it is unable to bind that pronoun. In the topicalization examples used in Experiment 1, that is exactly what happens:

(12)   Top: To the left of every princess, her lady in waiting stood with an extra cape.

This is presumably derived from the Base sentence, below, by A-bar movement:

(13)   Base: Her lady in waiting stood to the left of every princess with an extra cape.

In the standard analysis, the quantifier in the topicalized PP in (12) should be able to bind the pronoun as a variable only to the extent that it can in (13), where it presumably occupies the equivalent of an A-position for a PP.

However, this is not what was found in the two experiments reported here. In Experiment 1, participants rated the Top sentence in (12) significantly higher than the Base sentence in (13). In Experiment 2, participants chose the quantificational antecedent much more frequently in the topicalization items (the There items) than they did in the Base items. This seems to indicate that topicalizing the PP actually enables variable binding, contrary to the predictions of the standard account.

An alternative to the standard account is proposed by Eilam (2011). Eilam (2011) argues that weak crossover is not about the A- versus A-bar status of the position occupied by the quantifier; rather, the condition for a quantifier to bind a pronoun as a variable is that the quantifier has to be construable as a topic, while the pronoun has to be contained in an XP that can be construed as a focus. For instance, the reason that variable binding is not very acceptable in the Base sentence in (13) is that the default topic of a clause is the subject. The pronoun is then contained in a constituent that is a topic rather than a focus. At the same time, postverbal material in English is typically focused, making the quantifier a focus rather than a topic. In contrast, binding from a subject is uniformly acceptable, because the subject is the default topic and postverbal material is usually focused:

(14)   Every princess stood next to her lady in waiting.

Here, *every princess* is easily (and most naturally) construable as a topic, while *her lady in waiting* can be construed as a focus (and is, by default).

In Eilam's account, weak crossover arises in a standard A-bar movement scenario like wh-movement because in wh-movement, the quantifier (the wh-phrase) is the focus, not the topic:

(15)   * Who$_1$ does his$_1$ mother love?

At the same time, the pronoun is contained in the subject, which is the default topic, not the focus.

In this account, if a topicalized quantifier can be construed as a topic, while the constituent that contains the pronoun can be construed as a focus, then topicalization (A-bar movement) will enable variable binding. I suggest that this is what is going on in (12): participants can construe *every princess* as a topic, while *her lady in waiting* can be construed as the focus. *Her lady in*

waiting is the subject, which is the default topic, but if the fronted PP is construed as the topic instead, then the subject can be in focus. I suggest that this is exactly what is going on, and it is why participants readily permit variable binding. They can easily access the information structure that is required in Eilam's account of weak crossover.

In Experiment 2, the same information structure can be constructed for sentences with an overt *there*:

(16)   There: The old king said that beside every knight there stood his squire.

In the embedded clause, *every knight* can be construed as a topic, while the postverbal NP *his squire* can be construed as a focus. Hence, subjects answer with *every knight* as the antecedent for the pronoun a high percentage of the time. In contrast, in the corresponding Base sentence, the pronoun is contained in a preverbal subject, which is the default topic, while the quantifier is postverbal and hence a default focus:

(17)   Base: The old king said that his squire stood beside every knight.

Participants therefore respond much more rarely with the quantifier as the antecedent for the pronoun.

I take the findings of Experiments 1 and 2 to indicate that the standard account of weak crossover is not correct. A-bar movement does not uniformly lead to weak crossover. In some cases, it enables variable binding instead. The analysis of weak crossover proposed by Eilam (2011) is the best extant account of this phenomenon. It also makes sense of the pattern of results obtained in the two experiments reported here.

Turning to locative inversion, it is certainly compatible with the requisite information structure. Consider the following line from "The Three Billy Goats Gruff":

(18)   On the way up was a bridge over a cascading stream they had to cross; and under the bridge lived a great ugly troll...

Here, *the bridge* has just been mentioned and so it is a topic, while the great ugly troll has not yet been mentioned and is being introduced as a presentational focus. Having the subject postverbal in fact makes it a focus by default. Since the PP is or can be topical, while the postverbal subject is a focus, locative inversion then easily allows variable binding in Eilam's account:

(19)   In every dog$_1$'s cage hung its$_1$ collar.

Even out of the blue, the fronted PP can be construed as a topic, while the postverbal subject is the focus.

It is also possible to construe a preverbal subject as the focus, in the presence of a topicalized PP. We saw this in (12) above. In such cases, it may be that adding modifiers to the sentence helps to make this information structure more salient. This may be why (20b) sounds more natural than (20a) (examples repeated from the introduction):

(20)   a.   In every dog$_1$'s cage its$_1$ collar hung. (repeated from 2a, grammaticality judgment removed)

      b.   In every dog$_1$'s cage, its$_1$ collar hung from a hook welded to the bars. (repeated from 4)

In my judgment, simply adding focal stress to *collar* also helps in (20a). I take this to support the account proposed in Eilam (2011).

Let us now return to the topic of possible speaker variation, and the question of whether there might be two different grammars, one which permits variable binding from a fronted PP, and one which does not. As noted in the previous subsection, if there is a grammar that does not permit such binding, it belongs to a very small minority of speakers. Another possibility, however, is that such speakers have a harder time constructing the relevant information structure. Suppose that such speakers have a very strong preference for a preverbal subject to be the topic, even in the presence of a fronted PP. Then such speakers will not readily allow variable binding of a pronoun in the preverbal subject.

As for the distinction such speakers are purported to make between clauses with and without an overt *there*, there may be multiple factors at play. Recall that Postal (2004) and Bruening (2010) argued that any degradation in variable binding with an overt *there* is due to the definiteness effect with overt *there* rather than to the failure of variable binding. This is probably one factor. Another might be information structure again. We therefore predict that, if the pronoun can be contained in an indefinite focused phrase, while the fronted PP is saliently made a topic, then even speakers in this minority group should allow variable binding. Consider the following attempt:

(21) In the cavernous room were literally thousands of dogs. And...
  a.   ...in every dog's cage hung a glittering collar made especially for it.
  b.   ...in every dog's cage there hung a glittering collar made especially for it.

In this pair, the context sentence sets up the dogs as the topic. The postverbal NP is an indefinite, meaning that there should be no definiteness effect with overt *there*. The prediction is that every English speaker will allow variable binding in both members of this pair, even the English speakers who do not like variable binding with a fronted PP and an overt *there*. As of yet, I have not been able to test this prediction.

4.4   Overall Conclusion

This paper has reported on two experiments involving weak crossover and locative inversion. It found that the majority of English speakers permit a quantifier inside a fronted PP to bind a variable in both a preverbal subject and a postverbal subject with an overt *there*, contra some claims in the theoretical literature. These findings are most compatible with the information-structural analysis of weak crossover proposed by Eilam (2011), rather than the standard account where it is triggered by A-bar movement; and they are most compatible with the null expletive analysis of locative inversion, rather than the analysis where the PP is the subject.

Appendix A: Items for Experiment 1

1. (a) Base: Its collar hung from a hook in every dog's cage.
    (b) Top: In every dog's cage, its collar hung from a hook.
    (c) LocInv: In every dog's cage hung its collar from a hook.
    (d) Var: Every actress thinks that only her agent is honest.

(e) NoVar: Her agent thinks that every actress is talented.

2. (a) Base: Its diminutive rider sat on every horse waiting for the starting bell.

    (b) Top: On every horse, its diminutive rider sat waiting for the starting bell.

    (c) LocInv: On every horse sat its diminutive rider, waiting for the starting bell.

    (d) Var: Every queen believes that her guards are loyal to her.

    (e) NoVar: Her guards believe that every queen is safe from harm.

3. (a) Base: Its guard stood beside every door, impassively watchful.

    (b) Top: Beside every door, its guard stood impassively watchful.

    (c) LocInv: Beside every door stood its guardian, impassively watchful.

    (d) Var: Every king commands his subjects to celebrate his birthday.

    (e) NoVar: His subjects refuse to celebrate every king's birthday.

4. (a) Base: Her lady in waiting stood to the left of every princess with an extra cape.

    (b) Top: To the left of every princess, her lady in waiting stood with an extra cape.

    (c) LocInv: To the left of every princess stood her lady in waiting with an extra cape.

    (d) Var: Every princess hopes that her lady in waiting will be nice.

    (e) NoVar: Her lady in waiting hopes that every princess will be nice.

5. (a) Base: Her pet crow perched on every witch's shoulder with an evil eye.

    (b) Top: On every witch's shoulder, her pet crow perched with an evil eye.

    (c) LocInv: On every witch's shoulder perched her pet crow with an evil eye.

    (d) Var: Every witch claims that her magic potion is the most powerful of all.

    (e) NoVar: Her magic potion proves that every witch is the most powerful of all.

6. (a) Base: Her partner sat beside every policewoman, manning the radio.

    (b) Top: Beside every policewoman, her partner sat, manning the radio.

    (c) LocInv: Beside every policewoman sat her partner, manning the radio.

    (d) Var: Every cat likes to scratch its owner's skin.

    (e) NoVar: Its owner likes to scratch every cat's ears.

7. (a) Base: His personal bodyguard lurked behind every prince menacingly.

    (b) Top: Behind every prince, his personal bodyguard lurked menacingly.

    (c) LocInv: Behind every prince lurked his personal bodyguard menacingly.

    (d) Var: Every Jedi Master fears that his apprentice will go over to the dark side.

    (e) NoVar: His apprentice fears that every Jedi Master will go over to the dark side.

8. (a) Base: His name and a serial number were tattooed on every prisoner's wrist.

(b) Top: On every prisoner's wrist his name and a serial number were tattooed.

(c) LocInv: On every prisoner's wrist was tattooed his name and a serial number.

(d) Var: Every pop star wants her bodyguard to keep her safe from harm.

(e) NoVar: Her bodyguard wants to keep every pop star safe from harm.

9. (a) Base: His apprentice sat behind every warlock, stirring something in a cauldron.

(b) Top: Behind every warlock his apprentice sat, stirring something in a cauldron.

(c) LocInv: Behind every warlock sat his apprentice, stirring something in a cauldron.

(d) NoVar: Every dog hopes that its owner will enter it in the dog show.

(e) NoVar: Its owner hopes to enter every dog in the dog show.

Appendix B: Items for Experiment 2

1. (a) There: The old king said that beside every knight there stood his squire.

(b) LocInv: The old king said that beside every knight stood his squire.

(c) Base: The old king said that his squire stood beside every knight.
Whose squire is it? A: the old king's B: every knight's

2. (a) There: The TV anchorwoman reported that behind every congresswoman there sat her assistant.

(b) LocInv: The TV anchorwoman reported that behind every congresswoman sat her assistant.

(c) Base: The TV anchorwoman reported that her assistant sat behind every congresswoman.
Whose assistant is it? A: the anchorwoman's B: every congresswoman's

3. (a) There: The groundskeeper said that to every huntsman's left there lay his dog.

(b) LocInv: The groundskeeper said that to every huntsman's left lay his dog.

(c) Base: The groundskeeper said that his dog lay to every huntsman's left.
Whose dog is it? A: the groundskeeper's B: every huntsman's

4. (a) There: The medium claimed that behind every woman at the seance there stood her long-dead ancestor.

(b) LocInv: The medium claimed that behind every woman at the seance stood her long-dead ancestor.

(c) Base: The medium claimed that her long-dead ancestor stood behind every woman at the seance.
Whose ancestor is it? A: the medium's B: every woman's

5. (a) There: The policewoman reported that under every victim there lay her unused gun.

(b) LocInv: The policewoman reported that under every victim lay her unused gun.

(c) Base: The policewoman reported that her unused gun lay under every victim.
Whose gun is it? A: the policewoman's B: every victim's

6. (a) There: The anthropologist noted that in front of every warrior there crouched his child.

(b) LocInv: The anthropologist noted that in front of every warrior crouched his child.

(c) Base: The anthropologist noted that his child crouched in front of every warrior.
Whose child is it? A: the anthropologist's B: every warrior's

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