

# Amnestying Superiority Violations: Processing Multiple Questions

*Charles Clifton, Jr.*  
*Gisbert Fanselow*  
*Lyn Frazier*

Two experiments investigated the acceptability of multiple questions. As expected, sentences violating the Superiority Condition were accepted less often than sentences obeying it. The status of the Superiority violations was not improved by the addition of a third *wh*, regardless of whether the third *wh* was an adjunct or an argument, though it was improved by the addition of a second question (e.g., *and when*). Further, in a small pilot study directly comparing a sentence with adjacent final *wh*-phrases that may induce a stress clash (*I'd like to know who hid it where when*) with a sentence violating Superiority but avoiding the final adjacent *wh*-phrases (*I'd like to know where who hid it when*), half the participants indicated that the Superiority violation sentence sounded better. This suggests that the status of some additional-*wh* sentences may appear to improve simply because the comparison sentence with adjacent final *wh*-phrases is degraded. Overall, the results of the studies suggest that there is no need to complicate syntactic theory to account for the additional-*wh* effect, because there is no general additional-*wh* effect.

*Keywords:* additional-*wh* effect, superiority, multiple questions, acceptability judgments

## 1 Introduction

Within sophisticated grammatical models, syntactic argumentation often relies on rather subtle data contrasts. This implies a certain risk that the relevant data are not representative of the construction in question, or that they are due to factors other than syntactic rules. Many examples of this kind can be found in Schütze 1996.

In this article, we will be concerned with the amnestying effect that the addition of a third *wh*-phrase is claimed to have on violations of the Superiority Condition (see Kayne 1983). The data have played a crucial role in motivating chain- and path-based accounts of grammatical constraints (Kayne 1983) and have figured in general discussions of the functioning of syntactic principles (Richards 2001). Our experimental findings suggest, however, that such an amnestying effect of third *wh*-phrases does not exist.

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Let us first briefly summarize some major aspects of the discussion of superiority. All multiple questions are not equal. It has been known since Kuno and Robinson 1972 and Chomsky 1973 that a multiple question is more acceptable if the highest *wh*-element moves and the lower one remains in situ, as in (1a), than if the lower *wh*-element moves and the higher one remains in situ, as in (1b), a so-called Superiority violation.

- (1) a. Who will buy what?  
 b. \*What will who buy?

Superiority violations are part of a complex array of facts, to which several factors contribute. The actual presence of a superiority effect depends on the discourse status of the *wh*-phrases. The fronting of discourse-linked *which*-phrases seems fairly unrestricted, as the absence of a contrast in (2) suggests (see Kayne 1983 and Pesetsky 1987 for detailed discussion).

- (2) a. Which student will buy which book?  
 b. Which book will which student buy?

Similarly, contrastive focus on the verb increases the acceptability of Superiority violations, as already observed for examples such as (3) by Bolinger (1978) (see also Zubizarreta 1998). These aspects of Superiority violations will not figure prominently in this article.

- (3) I know what everyone was supposed to do. But what did who actually do?

Quite different accounts for the contrast in (1) can be found in the literature. Chomsky (1981) proposes to derive the superiority effect from the Empty Category Principle (ECP), which penalizes overt and covert *wh*-movement from ungoverned positions such as that of the subject in Spec,IP. The ECP is thus responsible for the fact that *wh*-in-situ subjects are quite unacceptable independently of whether they are crossed over by a further *wh*-phrase (as in (1b)) or not (as in (4a); Chomsky 1981:236). That the contrast in (1) is (partially) related to the ECP is supported by the following observation: discourse linking not only eliminates the superiority effect (2), it also renders in-situ *wh*-subjects quite acceptable in general, as the contrast between (4a) and (4b) shows (see Bresnan 1977, Chomsky 1981:236, Haider, to appear).

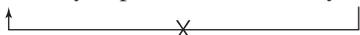
- (4) a. \*Who believes that who will win the prize?  
 b. (?)Who believes that which man will win the prize?

However, Hendrick and Rochemont (1982) and Hornstein (1995) point out that the ECP cannot be the only factor responsible for the superiority effect. Crossing movement is also ruled out if a *wh*-phrase is moved past an in-situ indirect *wh*-object or an infinitival *wh*-subject (5) (at least according to the judgments represented in the literature), even though in-situ *wh*-phrases are in general licensed in such positions (6).

- (5) a. Who do you expect \_\_\_\_\_ to buy what?  
 b. \*What do you expect who to buy \_\_\_\_\_?  
 c. Who do you persuade \_\_\_\_\_ to buy what?  
 d. \*What do you persuade who to buy \_\_\_\_\_?

- (6) a. Who expects who to win?  
 b. Who persuaded who to buy a new car?

Most current approaches to the superiority effect are therefore variations of the original proposal in Chomsky 1973 taking the tree-geometric relation between the two *wh*-phrases into account. Derivational approaches (such as that proposed in Chomsky 1995) make the assumption that phrases (such as *what* in (5b,d)) cannot move to some position P (the clause-initial one, in (5b,d)) if there is a phrase closer to P (*who* in (5b,d)) that could also move there.<sup>1</sup>

- (7) a. Who do you persuade \_\_\_\_ to buy what?  
  
 b. \*What do you persuade who to buy \_\_\_\_?  


Hornstein (1995) has proposed a third way of dealing with the violation in (1b). He treats it on a par with so-called Weak Crossover violations: X cannot cross over a bound variable Y if the interpretation of Y is dependent on X. Well-known crossover examples involve bound pronouns, as in (8). Superiority violations like (1b) can be viewed in a similar way, as Hornstein argues.

- (8) a. Who<sub>i</sub> loves his<sub>i</sub> mother?  
 b. \*Who<sub>i</sub> does his<sub>i</sub> mother love? (on the bound interpretation)

It comes as a surprise that adding a third *wh*-phrase seems to ameliorate multiple questions with Superiority violations, at least according to the literature. The contrast between (9a) and (9b) suggests that placing a third *wh*-phrase into a position c-commanding the offending *wh*-pair can render the structure well formed—but it seems to do so only when the lowest *wh*-phrase takes matrix scope<sup>2</sup> (see Golan 1993, Kitahara 1993, Reinhart 1995).

- (9) a. \*Bill wonders what who bought.  
 b. Who wonders what who bought?

A second type of amelioration, which we will focus on in this article, has been reported for constellations in which a *wh*-phrase is added in a position c-commanded by the violating *wh*-pair, as Kayne (1983) argues.

- (10) a. \*What did who buy there?  
 b. (?)What did who buy where?

<sup>1</sup> For representational accounts, see Müller 2001, Williams 2003.

<sup>2</sup> In other words, (9b) is well formed with the interpretation (i), and not with the interpretation (ii).

(i) for which x,y: x wonders what y bought

(ii) for which x: x wonders: “who bought what?”

The classical tree-geometric explanations of the Superiority Condition (and the ECP account) do not lead one to expect that the status of (10b) should differ from that of (10a). If there is a contrast in acceptability, such theories must be enriched by further assumptions, such as connectedness theory (Kayne 1983) and other approaches looking at movement paths (Pesetsky 1982), or the Minimal Compliance Principle (Richards 2001) claiming that the Superiority Condition need not be respected by more than one pair of *wh*-phrases in each clause (see also Pesetsky 2000). The third-*wh* effect would thus be among those data that force the addition of complications to otherwise simple and elegant grammatical models.

However, the model proposed by Hornstein (1995) seems to imply the amnestying effect of the third *wh*-phrase. For weak crossover cases such as (8b), it has been observed that adding a bound variable to the right ameliorates the violation, as illustrated in (11b) (see Hornstein 1995: 116).

- (11) a. \*Who<sub>i</sub> did his<sub>i</sub> mother tell \_\_\_\_\_ about John?  
 b. Who<sub>i</sub> did his<sub>i</sub> mother tell \_\_\_\_\_ about himself<sub>i</sub>?

If superiority is treated like crossover, then as Hornstein has argued, a Superiority violation also should be amnestied by a third variable, as in (12) (see Hornstein 1995:144). The third-*wh* effect could thus also be considered strong evidence favoring a weak crossover explanation of superiority.

- (12) a. \*What did who reveal about Paul?  
 b. What did who<sub>i</sub> reveal about his<sub>i</sub> mother?

However, a number of observations suggest that quick conclusions from the third-*wh* effect may be premature. First, the discussion of the amnestying effect of the third *wh*-phrase has focused on English data. It has largely gone unnoticed that this amnestying effect has only been reported in English. Many languages do not display simple superiority effects like that in (1) at all, so there is nothing that could be improved by the addition of a third *wh*-phrase. Multiple questions in other languages show a pattern quite reminiscent of English superiority, yet they do not exemplify a third-*wh* effect of the kind found in English. In Bulgarian, (agentive) *wh*-subjects must precede *wh*-objects in multiple questions, and this rule must not be violated even when a third *wh*-phrase is added (see Pesetsky 2000). Nor were amnestying effects reported by Aoun and Li (2003) in their careful analysis of superiority facts in Lebanese Arabic.

Second, even for English, the ubiquity of the effect reported for (10) and similar structures seems dubious. Thus, Pesetsky (2000:n.18) states that he has ‘‘encountered a few speakers who find (33b) [= structures corresponding to (10b)] less than perfect. All speakers acknowledge a contrast’’; and he adds, ‘‘From time to time I have encountered speakers of English who report a residual Superiority effect in those cases where other speakers report its disappearance. For these speakers the Superiority contrast weakens in questions with D[iscourse]-linking and in nonbinary multiple questions, but it remains detectable’’ (p. 45).

The results of a corpus search confirm the impression that a particular amnestying effect of a third *wh*-phrase is not beyond doubt. Searching the World Wide Web turns up a considerable

number of sentences in which a *wh*-object has crossed a *wh*-subject.<sup>3</sup> Many of these examples involve echo questions, as in (13).

- (13) “. . . Right. I know. So, what would she be like?” Rudy looked momentarily perplexed. “*What would who* be like?” “Never mind. Let’s just finish eating.” . . .  
([www.angelfire.com/oh5/thebeachhouse/bg4.htm](http://www.angelfire.com/oh5/thebeachhouse/bg4.htm))

However, other examples (such as (14a–c)) cannot be analyzed as echo questions. Only some examples (such as (15)) involve a third *wh*-phrase, which may, however, also appear in a conjoined clause (as in (16)).

- (14) a. . . . then maybe that horrible accident would have never happened. *What could who do now though?* It was too late to go back and change the terrible events that had taken place that night.  
(<http://tvmegasite.net/day/yr/fanfic/gone.htm>)
- b. It was Miller who served up Khidir Hamza, the self-proclaimed nuclear bomb-maker. . . . It was Miller who last year whipped up an amazing confection in the Times, blind-sourced from top to toe, about a Russian biowar scientist (sounding suspiciously like Lotte Lenya in *From Russia With Love*, and since deceased) ferrying Russian smallpox to Saddam. At least the Times’s headline writer tried to keep things honest this time. “*Illicit Arms Kept Till Eve of War, An Iraqi Scientist Is Said to Assert.*” *What did who say and who did the asserting?* It turns out that Miller, in bed with the entire 101st Airborne, had been told by “*American weapons experts*” in a group called MET Alpha that they have been talking to “*a scientist who claims to have worked in Iraq’s chemical weapons program.*”  
([http://www.dissidentvoice.org/Articles4/Cockburn\\_Judy-Miller.htm](http://www.dissidentvoice.org/Articles4/Cockburn_Judy-Miller.htm))
- c. How to select customer for order? How to restrict view by login id? *What should who see?* How is the catalogue item picked?  
([www.cs.ualberta.ca/~hoover/cmput660/readings/SoftwareArch/section/order.htm](http://www.cs.ualberta.ca/~hoover/cmput660/readings/SoftwareArch/section/order.htm))
- (15) Let’s start by making a job study in the home. *What does who do where?* Is the environment safe? Are the tools as safe as they can be made . . . ?  
(<http://www.rbc.com/community/letter/july1960.html>)
- (16) What is the conceptual significance of someone disagreeing with the thesaurus structure? *And what can who do about it and when?*  
([www.arts.uwa.edu.au/LingWWW/lin101/slides/lecture14.pdf](http://www.arts.uwa.edu.au/LingWWW/lin101/slides/lecture14.pdf))

Our informal Web search thus lends support to Bolinger’s (1978) view that special pragmatic circumstances such as the ones exemplified by (3) indeed license or at least ameliorate Superiority violations in natural texts. The crossing of a *wh*-subject by a *wh*-object in a triple question is also

<sup>3</sup> One can find such sentences by entering *what can who*, *what could who*, and so on, as search terms at [www.google.de](http://www.google.de). In many of the items so retrieved, *who* stands for *World Health Organization*. We ignored these. All examples cited were retrieved on June 19, 2004, around 9 p.m. CEST.

exemplified on the Web, but we found no evidence that the phenomenon in (15) is different from the one exemplified in (14) or (16).

We have not done a full-scale quantitative analysis of corpus examples. However, of the 26 nonecho multiple questions we found on the Web that did not respect the Superiority Condition, 5 were triple questions. For a comparison, we analyzed the first 50 results found by Google for *who has said what* and *who has done what* (with a multiple question rather than a relative clause reading, as in *a person who has done what you have suggested*). Of these, 15 were monoclausal questions involving at least three *wh*-words. To the extent that both Web searches were representative, one can conclude that the number of triple questions among the sentences on the Web disrespecting the Superiority Condition is not larger than the number of triple questions among all multiple questions. This observation lends no support to the idea that there is a special ameliorating effect of adding a third *wh*-phrase to a sentence with a Superiority violation.

Such informal observations suggest the need for a systematic look at the possible effect of a third *wh*-phrase on the status of Superiority violations. Below, we report two experiments designed to gather evidence about the effect of adding a third *wh* to a multiple question—specifically, whether a third *wh* improves the status of a question that violates Superiority. Several single-item exploratory studies then address how adjacent interrogative phrases in a non-Superiority violation sentence might lead to the appearance of an effect of a third *wh* on a Superiority violation sentence.

Experiment 1 required speeded acceptability judgments from a fairly large number of nonlinguist participants, while Experiment 2 and the single-item studies were offline studies designed to gather judgments by asking participants to rate sentences (e.g., on a scale from 1 to 5). The absolute values obtained in such rating studies mean little. They depend in part on the nature of the distractor items included in the study. What is of most interest is the relative acceptability of minimal pairs included in the study. Although there is certainly some “slop” in data collected from large populations, systematic differences in the relative ratings assigned to minimal pairs can be very informative and can help in constructing an empirically grounded linguistic theory.

Linguists’ intuitions about sentences are a rich and invaluable source of evidence and hypotheses about the grammar. But when intuitions are particularly subtle, systematically gathering intuitions seems important to confirm intuitive generalizations. Gathering intuitions from nonlinguists is also important in order to sidestep unintended consequences that one’s theoretical beliefs about grammar may have on intuitions. The way intuitions are gathered also matters, given that intuitions are judgments and thus are affected by the myriad factors that influence perceptual and cognitive judgments in general (see Schütze 1996). As with any form of evidence, intuitive evidence will be most trustworthy when data from various sources—including linguists’ intuitions, intuitions from nonlinguists, corpus evidence, and so on—all converge.

## 2 Experiment 1

Experiment 1 was designed to investigate whether a third *wh*-element does ameliorate a Superiority violation in English and, if so, whether it completely amnesties the violation. Following the

observations concerning (16), we also included examples with *and when* to compare the effect of a third *wh* with the effect of a second question (assuming that *and when* asks a second question).

If the addition of a third *wh*-element completely amnesties the Superiority violation, then (17b) should be judged better than (17a), which contains a Superiority violation, and it should be judged as acceptable as (17d), which obeys Superiority. If the addition of the third *wh* simply ameliorates the violation, then (17b) should be judged as intermediate between the unobjectionable (17d) and the Superiority violation (17a). Concerning (17c), the standard theories of superiority make no predictions. If (17c) were to be judged as good as or better than (17b), this would suggest that current approaches to the additional-*wh* effect are at least incomplete.

## 2.1 Methods

**2.1.1 Materials** Sixteen multiple questions were constructed, with four versions of each, as illustrated in (17).

- (17) a. What can who do about it?  
 b. What can who do about it when?  
 c. What can who do about it, and when?  
 d. What can you do about it, and when?

The (a) form contained a fronted *what*-object and *who*-in-situ in subject position. The (b) form was identical to the (a) form apart from the addition of a third *wh*. In half the forms, the third *wh* was an adjunct (*when, where*); in half, it was a goal argument (*to whom*). The (c) form was identical to the (b) form except that *and* was added before the third *wh*. After considerable discussion with nonlinguist undergraduates, it was decided that *and wh* should be preceded by a comma. This was because the undergraduate informants found the question much more acceptable with the comma than without. In the (d) form, the subject *who* was replaced by *you* so that the question in (d) contained only two *wh*-elements and no Superiority violation. All experimental sentences appear in appendix 1.

The full experimental list consisted of 136 sentences, including the 16 experimental sentences used in Experiment 1. There were 36 clearly unacceptable fillers and 4 acceptable fillers, plus 80 items from other, unrelated experiments, which varied in acceptability. Four different counterbalanced lists were constructed, each containing a given item in a different one of the four experimental conditions. Across the four counterbalanced lists, each sentence was tested equally often in each condition.

**2.1.2 Participants and Procedures** Forty-eight University of Massachusetts undergraduates participated in individual half-hour speeded acceptability judgment sessions for extra course credit. They were instructed that they would see a variety of different sorts of single sentences or short discourses. Some (including all of the Experiment 1 items) would be presented all at once on a computer-controlled video monitor, and some in phrase-length segments. Underscore marks were presented as previews of where letters would occur. When a response key was pressed, these marks turned into letters; when multiple segments were presented on a trial, the letters reverted

to underscores and the underscores then turned into the letters of the next segment. In either case, the participant was to read what was presented at a comfortable rate until the end of the display, when the last underscores had become letters, and then judge as quickly as possible whether or not the sentence or discourse was acceptable. Participants indicated acceptability by pressing a response key with their right hand (the key they had used to advance through multiple presentation segments) and unacceptability by pressing a key with their left hand. Their choice and reaction time (from the initial presentation of the whole sentence in the case of the Experiment 1 items) were measured.

Participants were told that they should classify a sentence or discourse as “acceptable” if it was an “ordinary, well-formed, acceptable sentence or pair of sentences in English.” They were further told that anything that violated the normal rules of everyday English should be rejected, but that a sentence did not have to be insightful, true, or elegant to be accepted. As practice, they completed a written questionnaire with 10 sentences and short discourses, 5 of which were unacceptable because they were ungrammatical (e.g., violated number agreement) or nonsensical. The experimenter discussed any cases where the participant misclassified the items on this questionnaire.

A session began with a six-item practice list, followed by the full experimental list, which appeared in a different random order for each participant.

## 2.2 Results

Table 1 presents the mean percentages of acceptability judgments together with the mean reaction times taken to make a judgment (averaged over “acceptable” and “unacceptable” judgments). It is clear that the Superiority violations were accepted infrequently, only 25% of the time. Adding a third *wh*-element did not increase the acceptability of these sentences. Adding a separate question as in the (c) form did improve their acceptability by roughly 20%. However, the corresponding (d) question without a Superiority violation was judged much more acceptable (81%) than any other form. As mentioned in section 1, the absolute level of acceptability is probably not trustworthy. Nevertheless, the relations between the different forms are clear: (a), (b) < (c) < (d).

Analyses of variance were conducted on the percentage and reaction time data. No effect of adjunct versus argument was significant; the same patterns of data held for both. The difference among the percentage acceptable means for the four conditions was highly significant ( $F(3,$

**Table 1**

Percentages of “acceptable” responses and mean reaction times (in ms), Experiment 1

Sentence form	Percentage “acceptable”			Reaction time		
	Adj <i>wh</i>	Arg <i>wh</i>	Mean	Adj <i>wh</i>	Arg <i>wh</i>	Mean
a. What . . . who . . . ?	22	28	25	3,226	3,399	3,313
b. What . . . who . . . when?	26	29	28	3,993	4,314	4,154
c. What . . . who . . . , and when?	44	50	47	4,289	4,479	4,384
d. What . . . you . . . , and when?	81	85	83	3,154	3,359	3,257

141) = 54.16;  $F2(3, 42) = 83.96$ ;  $p < .001$ ).  $t$ -tests indicated that each condition mean differed significantly ( $p < .001$ , after Bonferroni correction) from each other condition mean, except for the first two conditions, which did not differ. Mean reaction times also differed among the conditions ( $F1(3, 141) = 23.81$ ;  $F2(3, 42) = 23.59$ ;  $p < .001$ ). This difference is difficult to interpret because reading and decision times for sentences of differing lengths are being compared; but for the record, conditions (a) and (d) did not differ from each other, nor did conditions (b) and (c), but both conditions (a) and (d) differed ( $p < .001$ , after Bonferroni correction) from both conditions (b) and (c). At the least, one can conclude that condition (d), with no Superiority violation, was read quickly, despite its relative length.

This pattern suggests that Superiority violations like those tested are not acceptable and that simply adding another *wh* does not always remedy matters, as shown by the relatively low acceptability of (b) (28% acceptable) and the fact that its acceptability does not differ from the two-*wh* (a) form. Our results may be interpreted as showing that the addition of a third *wh*-phrase does not per se increase the grammaticality of a multiple question with a Superiority violation.

It is possible that the third *wh* did not help the Superiority violations because the presence of a third *wh* increases sentence complexity. Other studies have shown that processing difficulty reduces acceptability (see Fanselow and Frisch, to appear, for an overview), so that the mitigating effect of adding the third *wh*-phrase may simply have been offset by the decrease in acceptability due to processing difficulty. We check for this possibility below in Experiment 2.

### 3 Experiment 2

Experiment 2 was an offline rating study conducted in large part as a control for whether the mere addition of a third *wh*-element adds so much complexity to a question that this complexity could completely offset the amnestying effect that is our central interest. The rating questionnaire examined three different sentence versions with a Superiority violation. One version contained a third *wh* and a second version contained the sequence “, and *wh*,” as in (18e–f). The questionnaire also contained the corresponding non–Superiority violation versions of these items, to see whether these were affected by the third *wh*.

#### 3.1 Methods

Forty-eight University of Massachusetts undergraduates completed two written questionnaires. The first (not relevant to the present study) contained 32 sentences, each followed by two choices of what the sentence meant. These sentences contained ambiguities in the interpretation of connectives (*and*, *or*, etc.). The second questionnaire contained a total of 56 sentences, each to be rated on a 5-point scale from 1 (= unacceptable) to 5 (= acceptable). These 56 sentences included 16 items like those in (18). These sentences were derived from those used in Experiment 1 by eliminating the single-*wh* version (17a) and adding the licit forms of the Superiority violation sentences. Each sentence occurred in six different versions (18a–f). Three (d–f) contained Superiority violations due to fronting of an object interrogative *what* over a subject interrogative *who*; three (a–c) left the object interrogative constituent in situ. The (a,d) forms contained only two *wh*-items. The (b,e) forms had an additional *wh*-item (e.g., *when*). The (c,f) forms included a

comma followed by a conjoined phrase (e.g., “, and when”). Eight of the 16 sentences contained an adjunct (e.g., *when*) as the additional *wh*-item, and 8 contained an argument (*to whom*). All sentences appear in appendix 2.

	All	Adj	Arg
(18) a. Who can do what about it?	3.73	3.34	4.13
b. Who can do what about it when?	3.02	2.67	3.36
c. Who can do what about it, and when?	3.64	3.72	3.57
d. What can who do about it?	2.27	2.39	2.16
e. What can who do about it when?	2.27	2.33	2.22
f. What can who do about it, and when?	2.53	2.52	2.55

Six different counterbalanced forms of the questionnaire were constructed, each containing a different version of a given sentence. Thus, across all six forms, each sentence was tested equally often in each version. The 16 sentences of this experiment were interspersed with the remaining 40 sentences in a different random order for each form. Because 16 different sentences were used, each questionnaire form contained either two or three instances of each sentence version. Six participants completed each form of the questionnaire, working individually.

### 3.2 Results and Discussion

The question is whether the acceptability ratings would indicate a large decrease in acceptability of a licit *wh*-question when a third *wh*-element was included—that is, low ratings for the (b) and (c) forms. If so, then perhaps the lack of a beneficial effect of a third *wh* in Experiment 1 was hidden by the complexity of the third *wh*.

The mean rating values for the six different versions of the sentences appear in (18). The licit questions (a–c) were rated much more acceptable than the illicit ones (d–f) (3.49 vs. 2.32;  $F(1, 47) = 98.42, p < .001$ ). The difference among the three condition means was also significant ( $F(2, 94) = 9.54, p < .001$ ), and, most important, the pattern of differences differed between licit and illicit questions ( $F(2, 94) = 9.93, p < .001$ ). For the licit questions (the (b) forms), the third *wh* did decrease the acceptability rating of the question. By contrast, a third *wh* did not have any effect on the acceptability of the Superiority violation sentences (the (c) forms).<sup>4</sup>

Experiment 2 can be interpreted as suggesting that the third *wh* may have slightly alleviated the Superiority violation in the (e) forms by an amount just offset by the added complexity that the third variable introduced, resulting in no net alleviation. The experiment does not therefore allow us to conclude that the third *wh* is completely irrelevant to the acceptability of Superiority violation sentences. However, it is certainly a minor factor, comparable in impact to the mild increase in complexity brought about by adding a third *wh*. The data certainly do not encourage

<sup>4</sup> In a secondary analysis, the items were divided into those where the third variable was an adjunct, *when*, and those where it was an argument, *to whom*. While the difference in acceptability between Superiority violation and licit sentences was smaller for the adjunct cases (means of 2.41 vs. 3.24) than for the argument cases (means of 2.31 vs. 3.69), this difference held even for the cases without a third variable. The effects of adding the third variable did not differ between argument and adjunct sentences, similar to what was observed in Experiment 1.

the view that the third *wh* actually amnesties the Superiority violation. Taking the acceptability of the licit double question (18a) as the base (3.73), the decrease in acceptability due to the added complexity of a third *wh*-phrase (18b) is much smaller (to 3.02) than the decrease in acceptability caused by the Superiority violation (18d) (to 2.27).

However, the data also suggest that in spite of the added complexity it presumably brings, adding a third *wh* set off by a comma and a conjunction (“, *and when*”; “, *and to whom*”) did help the Superiority violation selectively. A *t*-test comparing the means of conditions (18d) and (18f) was significant ( $t(47) = 2.15, p < .04$ ). We return to this effect below.

In Experiments 1 and 2, a comma was present only in the “, *and when*” and “, *and to whom*” cases—the cases that tended to be judged most acceptable. Perhaps the comma itself influenced judgments. To be sure that the difference between the three-*wh* and the added-question conditions was not due to the presence of the comma, no-comma (19) and comma (20) Superiority violation examples were compared in a single-item study to see if the presence of a comma increased the acceptability of the three-*wh* Superiority violations. Forty-four participants saw the pair in (19) and a separate set of 34 participants saw the pair in (20) after they completed a scheduled examination in a psychology course. The participants were simply asked to indicate the member of the pair that was “more acceptable, more natural sounding, easier to comprehend.” The number of participants who preferred each sentence is shown by the numbers following the sentences in (19) and (20).

(19) a.	What can who do about it?	37
	b. What can who do about it when?	7
(20) a.	What can who do about it?	22
	b. What can who do about it, when?	12

Results on the comma and no-comma forms did differ. For the comma form, the two-*wh* form was preferred to the three-*wh* form at roughly a 2:1 ratio, whereas for the no-comma form, the two-*wh* form was preferred to the three-*wh* form at a higher, 5:1 ratio. A chi-square test indicated that this difference was significant ( $\chi^2(1) = 4.07, p < .03$ ). The results clearly show that it is the form with the comma that impairs acceptability less. However, since even with a comma present the three-*wh* form was less preferred than the two-*wh* form, the failure to find an amnestying effect for the third *wh* in Experiment 1 cannot be attributed to the absence of a comma before the third *wh*. We note that only a single item was used in this study, so we have no statistical basis for generalizing to other sentences with Superiority violations. However, the single item used was essentially devoid of content, which suggests to us that the observed effects have a structural basis and should contribute to the acceptability of structurally similar sentences with substantive content.

#### 4 General Discussion

To begin, a summary of the findings seems in order. The present results clearly confirm that Superiority violations are not fully acceptable in English. Furthermore, merely adding a third *wh*-item per se did not eliminate the unacceptability of Superiority violations. This held true whether

the third *wh*-item was an adjunct or an argument (and, in the single-item study described in the discussion of Experiment 2, whether or not the third *wh*-item was preceded by a comma). The failure of a third *wh* to ameliorate the Superiority violation in Experiments 1–2 contrasts with the situation for weak crossover, where according to the literature a third variable helps (and we concur). We have assumed throughout that the empirical findings about weak crossover are as would be expected from the literature. However, the results of our experiments do not support the claims of weak crossover accounts of superiority (Hornstein 1995), which predict that Superiority violations should behave like weak crossover violations and, in particular, should be ameliorated by the presence of a third *wh*.

Our results are more in line with classical approaches to superiority effects such as Chomsky's (1973, 1995), according to which a *wh*-phrase cannot cross a *c*-commanding *wh*-phrase when it moves up to Spec,CP. In these very simple models, the presence or absence of a further *wh*-phrase in the clause is irrelevant for the well-formedness of a crossing movement. The empirical facts of English are thus not only predicted by the simpler theories, but also in line with what we observe in other languages. Models that try to account for intuitive claims that adding a third *wh*-phrase alleviates Superiority violations need to complicate the grammatical models (connectedness effects, Kayne 1983; Minimal Compliance Principle, Richards 2001; see also Pesetsky 2000, Haider, to appear). The results of our experiments suggest that such complications are not warranted: there is no general ameliorating effect of adding a third *wh*-phrase. The theory of superiority can (in general) be kept quite simple. Whether or not the additional complications proposed by Kayne or Richards are motivated by facts from the other construction types they have considered is beyond the scope of this article.

Although our investigations do not support the idea that adding a third *wh* improves a Superiority violation as such, there are examples where intuitively one feels that the Superiority violation sentence is as acceptable as its non-Superiority violation counterpart. We think this is because some of the three-*wh* questions without a Superiority violation contain another problem—for example, the appearance of several adjacent unmoved *wh*-phrases involving a stress clash that the Superiority violation questions can avoid. Although detailed investigation of the intonational properties of multiple questions is certainly in order, in some examples, such as (21b) below, it seems quite felicitous to accent only the first *wh*, or to accent both but to separate the two with a prosodic boundary. This prosodic boundary eliminates the clash and does not violate normal syntax-prosody mapping rules, assuming that a prosodic boundary may generally occur at the beginning of an embedded IP. By contrast, to separate the adjacent *wh*s in (21a), one must place a prosodic boundary between them, resulting in an unusually short one-syllable prosodic phrase.

A preliminary test of the clash idea obtained relative acceptability judgments from single pairs of sentences, using the single-item in-class examination procedure described at the end of the discussion of Experiment 2. This exploratory study checked to see if the Superiority violation in (21b) may be ameliorated compared with the Superiority violation in (22b). The examples in (23) were also included to determine whether any relative advantage of the Superiority violation (21b) was actually due to amelioration of that sentence or due to decreased acceptability of the

licit (21a) because of its third *wh*. If (21b) were actually ameliorated, then the acceptability of (23b) (identical to (21b)) relative to (23a) (identical to (22b)) should be increased. However, if any relative acceptability of (21b) were actually due just to the unacceptability of (21a), the preference for (23a) relative to (23b) should be comparable to data presented earlier (e.g., the single-item study testing (20)).

(21) a.	I'd like to know who hid it where when.	18
b.	I'd like to know where who hid it when.	19
(22) a.	I'd like to know who hid it where.	37
b.	I'd like to know where who hid it.	6
(23) a.	I'd like to know where who hid it.	29
b.	I'd like to know where who hid it when.	9

Strikingly, (21b) was chosen just as often as (21a), even though (21b) had a Superiority violation and (21a) did not. The previously observed dispreference for a Superiority violation was also observed in (22b) versus (22a), sentences that contrasted with (21a–b) by having only two *wh*-variables. Also, adding a third *wh* to the Superiority violation (23b) makes it dispreferred compared with the two-*wh* Superiority violation sentence (23a). The magnitude of the dispreference is very similar to what was observed in the single-item study reported at the end of Experiment 2. This pattern of data provides a hint about the nature of the third-*wh* effect assumed in the literature. For some sentence forms, moving a lower *wh*-phrase may in fact make the sentence sound better, even though it results in a Superiority violation. In the sentences usually tested in the literature, ones with a subject *wh* and an object *wh*, this will only arise if a third *wh* is added. However, the acceptability of the three-*wh* sentence with the Superiority violation is not increased in absolute terms, but only relative to its counterpart without a Superiority violation but with adjacent *wh*-phrases. In that respect, the results of the single-item study are in line with the decrease in acceptability found when a third *wh*-phrase was added to a well-formed structure in Experiment 2.

We are thus suggesting that a third *wh* can appear to ameliorate a Superiority violation sentence if such a sentence is directly compared with a licit sentence that contains a stress clash ((21a) vs. (21b)). We explored this suggestion by examining licit and illicit sentences with a second question, ‘, *and when*.’ Experiments 1 and 2 had indicated that such a second question modestly increased the acceptability of Superiority violation sentences. However, since the licit sentence with ‘, *and when*’ (as in (24a)) does not have the stress clash apparent in (21a), our suggestion for why (21a) and (21b) were judged equally acceptable does not apply to sentences like (24a) and (24b).

We tested this suggestion by obtaining relative acceptability judgments for (24a) and (24b) in another single-item exploratory study, predicting that the licit (24a) would be strongly preferred over the Superiority violation (24b). Examples (25a) and (25b) were included to confirm our earlier observation that ‘, *and when*’ does in fact partially ameliorate a Superiority violation. Two groups of 35 University of Massachusetts undergraduates received one pair of sentences using the same procedures as the other single-item studies, and were asked to indicate which member of the pair was more acceptable.

- (24) a. I'd like to know who hid it where, and when. 27  
 b. I'd like to know where who hid it, and when. 8
- (25) a. I'd like to know where who hid it. 8  
 b. I'd like to know where who hid it, and when. 27

The addition of the second question, “, *and when*,” does not eliminate the Superiority violation, as shown by the preference for the licit (24a) over the Superiority violation (24b). Nonetheless, the second question does ameliorate the Superiority violation to some extent, as shown by the comparison between (25a) and (25b). Indeed, it is striking that (25b) is preferred despite being more complex than (25a).

The pattern of results in these single-item studies can be further interpreted because the same sentences were included in different comparisons (specifically, (21b) = (23b), (22b) = (23a) = (25a), and (24b) = (25b)). The preference for the licit (22a) over (22b) can be contrasted with the lack of preference between (21a) and (21b). The preference for (22a) over (22b) holds even though the dispreferred two-*wh* Superiority violation sentence ((22b) = (23a)) is sharply preferred over the three-*wh* Superiority violation sentence ((23b) = (21b)), which in turn was found equally as acceptable as the licit (21a) stress clash sentence. The conclusion seems to be that, while a second question, “, *and when*,” does ameliorate a Superiority violation, the apparent ameliorative effect of simply adding the third *wh*-phrase *when* is only due to the preference for avoiding adjacent *wh*-phrases in licit sentences with a third *wh*, like (21a).

In short, when a sentence that violates Superiority is directly compared with a sentence that obeys Superiority but contains adjacent *wh*-phrases ((21a) vs. (21b)), our preliminary evidence suggests that the Superiority violation is as acceptable as the sentence without a violation. However, we have also conducted a single-item study (not reported here) where the Superiority violation (21b) was rated for acceptability on a 5-point scale by one group of subjects ( $N = 610$ ) while (21a) was rated by a different group of subjects ( $N = 580$ ). In this case, the sentence with the Superiority violation was rated significantly worse than the sentence without a violation (4.28 vs. 4.09, where 5 = unacceptable;  $p < .001$ ). This suggests that some of the variability in the judgments on the effect of the third *wh* may be due to the method used to gather intuitions: given minimal pairs that highlight the contrast, avoiding adjacent *wh*s improves the relative status of a sentence. We conclude that the status of the justified-violation example does not actually improve. At most, it only appears to improve because of the more degraded status of the awkward sentence with which it is compared. The fact that judgments are influenced by a contextually highlighted comparison need not imply a hierarchy of violations; in general, perceptual and cognitive judgments vary depending on the comparison set.

Though adding a third *wh* in the same clause as the other *wh*-phrases did not amnesty the Superiority violation, adding a second question (“, *and when*”) did help. Perhaps the second question simply attracts attention away from the Superiority violation. It would not be surprising in general if embedding a violation earlier in a sentence or in a longer sentence would, other things being equal, tend to result in less degradation than placing the violation in focus at the end of a short sentence.

The prosody of sentences with multiple *wh*s may also be extremely important in determining their acceptability. Prosody has not been controlled in our written studies or in the standard

examples in the literature. Consider for example (26), discussed by Hornstein (1995) and attributed to Kayne.

- (26) a. \*John wonders what who saw then.  
 b. John wonders what who saw when.

Our intuition suggests that (26a) is difficult to pronounce because normal rules of accentuation would place an accent on *saw* but not on the function word *then*. (26b) sounds better, but only if a very prominent accent is placed on *when*. Speakers should be tempted to place more emphasis on *when* than *then* because of the focus associated with interrogative constituents (Schafer et al. 2000). But this implies that the difference between the examples in (26) may have more to do with how acceptable it is to place a heavy accent on *then* versus *when* than it does with the amnestying effect of a third *wh*. In any case, we are currently investigating prosodic contributions to intuitions about Superiority violations. (See also Zubizarreta 1998 for one perspective on how prosody influences the perceived acceptability of Superiority violations.)

## 5 Conclusions

From the results of the experiments reported here, we conclude that there is no general amnestying effect of adding a third *wh*-phrase to sentences with a Superiority violation. By contrast, adding a bound variable to a weak crossover sentence does improve its status, according to our intuitions and the intuitions reported in the literature. We thus believe our results disconfirm the central prediction of the crossover account of superiority.

Syntactic theory has come a very long way in a relatively short time relying on intuitions as its central empirical base. However, today the sorts of intuitions required for the sophisticated issues at the forefront of the field often concern rather complex marginal sentences involving contrasts much more subtle than those at issue, say, 20 years ago. Even the intuition of the unacceptability of (27a) (previously discussed as (12a)) is subtle not because the sentence is terribly complex but because the true comparison involves the contrast between the sentence pair in (27) and the contrast between the pair in (28). Is the contrast in (27) actually larger than the one in (28)? That question is really what is at issue in terms of whether adding a bound variable improves Superiority violations.

- (27) a. \*What did who reveal about Paul?  
 b. What did who reveal about his mother?  
 (28) a. Who revealed what about Paul?  
 b. Who revealed what about his mother?

Increasingly, it is becoming important to know what comparison set influences judgments. Is it only those in the same ‘‘reference’’ set (Fox 1999, Reinhart 1995), or is the comparison set fluid depending on the presentation of sentences and the task?<sup>5</sup> Or is the comparison set something

<sup>5</sup> See Hirotani 2004 for a clear indication that sentence structures that are normally pronounced with prosodies that overlap in their distribution begin to be pronounced with distinct prosodies only when they are presented in pairs highlighting the contrast.

that is relevant only under some conditions for some structures but grammaticized for others? We think superiority offers a rich empirical ground for testing these possibilities.

### Appendix 1: Materials used in Experiment 1

The four alternatives are separated by | signs.

1. What can who do about it? | What can who do about it when? | What can who do about it, and when? | What can you do about it, and when?
2. What did who buy? | What did who buy where? | What did who buy, and where? | What did you buy, and where?
3. What will who contribute? | What did who contribute when? | What did who contribute, and when? | What did you contribute, and when?
4. What will who paint? | What will who paint where? | What will who paint, and where? | What will you paint, and where?
5. What will who promote? | What will who promote when? | What will who promote, and when? | What will you promote, and when?
6. What will who photograph? | What will who photograph when? | What will who photograph, and when? | What will you photograph, and when?
7. What did who read? | What did who read when? | What did who read, and when? | What did you read, and when?
8. What must who revise? | What must who revise when? | What must who revise, and when? | What must you revise, and when?
9. What did who donate? | What did who donate to whom? | What did who donate, and to whom? | What did you donate, and to whom?
10. What did who write? | What did who write to whom? | What did who write, and to whom? | What did you write, and to whom?
11. What did who send? | What did who send to whom? | What did who send, and to whom? | What did you send, and to whom?
12. What will who bring? | What will who bring to whom? | What will who bring, and to whom? | What will you bring, and to whom?
13. What will who complain about? | What will who complain about to whom? | What will who complain about, and to whom? | What will you complain about, and to whom?
14. What will who sing? | What will who sing to whom? | What will who sing, and to whom? | What will you sing, and to whom?
15. What did who make fun of? | What did who make fun of to whom? | What did who make fun of, and to whom? | What did you make fun of, and to whom?
16. What will who mention? | What will who mention to whom? | What will who mention, and to whom? | What will you mention, and to whom?

### Appendix 2: Materials used in Experiment 2

Scale and all six versions shown for item 1. In other cases, only the licit form is shown, with an indication of the third variable.

## 1. Who can do what about it?

1 2 3 4 5

unacceptable

acceptable

Who can do what about it when?

Who can do what about it, and when?

What can who do about it?

What can who do about it when?

What can who do about it, and when?

## 2. Who bought what (where /, and where)?

## 3. Who contributed what (when /, and when)?

## 4. Who will paint what (where /, and where)?

## 5. Who will promote what (when /, and when)?

## 6. Who will photograph what (when /, and when)?

## 7. Who read what (when /, and when)?

## 8. Who must revise what (when /, and when)?

## 9. Who donated what (to whom /, and to whom)?

## 10. Who wrote what (to whom /, and to whom)?

## 11. Who sent what (to whom /, and to whom)?

## 12. Who will bring what (to whom /, and to whom)?

## 13. Who will complain about what (to whom /, and to whom)?

## 14. Who will sing what (to whom /, and to whom)?

## 15. Who made fun of what (to whom /, and to whom)?

## 16. Who will mention what (to whom /, and to whom)?

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(Clifton)

Department of Psychology  
University of Massachusetts  
Amherst, Massachusetts 01003  
cec@psych.umass.edu

(Fanselow)

Universität Potsdam  
Institut für Linguistik / Allgemeine Sprachwissenschaft  
Postfach 601553  
D-14415 Potsdam Germany  
fanselow@rz.uni-potsdam.de

(Frazier)

Department of Linguistics  
University of Massachusetts  
Amherst, Massachusetts 01003  
lyn@linguist.umass.edu