ON MULTIPLE WH-CONSTRUCTIONS IN ENGLISH

Yong-Suck Kim

The aim of this paper is to argue for a descriptive principle for so-called "superiority" effects concerning multiple wh-constructions in English. That is, this paper proposes the principle of scope-binding (PSB) as an alternative to LF conditions such as the ECP, the PCC and the GBT, which have been independently suggested in the GB framework. The PSB is regarded as a sort of scope interpretation principle for wh-in-situ extensively found in multiple wh-constructions in English, equipped with the mechanism of coindexation that contributes to the determination of a relevant scope for wh-in-situ at S-structure. It is consequently demonstrated that many empirical problems resulting from the effect of such LF approaches in the GB framework may disappear in a framework with the PSB that is assumed to apply to S-structure representation after coindexation of wh-in-situ with [+WH] COMP.

1. Introduction

In this paper, I will propose an S-structure interpretation principle for the scope of wh-phrases found in multiple wh-questions in English as an alternative to LF interpretations of them constrained by one of the conditions such as the empty category principle (ECP), the path containment condition (PCC), the generalized binding theory (GBT), etc., all of which have been suggested independently within the GB framework for various complement-noncomplement asymmetries involving superiority effects resulting from multiple wh-questions in most of configurational languages.

It has been exclusively assumed in GB that certain wh-in-situ which are unmoved at S-structure actually undergo wh-movement in the mapping from S-structure to LF. In English, wh-in-situ are found widely in multiple wh-constructions, as in (1a), whose S-structure is given in (1b): the wh-phrase what is an instance of wh-in-situ. Along with the assumption of Lasnik & Saito (1984), the LF representation for (1a) may be roughly shown as in (1c).

(1) a. Who read what?
   b. [s [COMP who₁] [s t; read what]]
The LF representation mapped from S-structure by movement of *wh*-in-situ has been presumed to be the unique syntactic level reflecting the scope of *wh*-phrases in multiple *wh*-constructions in the tradition of generative grammar. According to this assumption, we can account for the scope ambiguities as revealed in (2) in terms of syntactic hierarchy represented in LF.

(2) Who knows where we bought what?

Two types of LF representation for (2) are derived depending on where the *wh*-in-situ *what* is moved to, as shown in (3).

(3) a. [[[COMP who,] t, knows [[[COMP what, where,] we bought t, t,]]]
   b. [[[COMP what, who,] t, knows [[[COMP where,] we bought t, t,]]]

The scope ambiguity with regard to *what* is due to the different types of LF representation in (3): the narrow scope reading of *what* is assumed to result from (3a); the wide scope reading from (3b).

Let us now consider the contrast in grammaticality between the following sentences.

(4) a. Who does Mary expect bought what?
   b. *What does Mary expect who bought?

Chomsky(1976) proposed that a constraint on movement at S-structure, that is, the so-called superiority condition, can make the correct distinction in (4). It is formulated as follows:

(5) Superiority Condition
   No rule can involve X, Y in the structure
   ...X...[a ...Z...—WYV...]...
   where the rule applies ambiguously to Z and Y and Z is superior to Y.

---

1 This proposal for assigning scope to *wh*-in-situ stems from Chomsky(1976), and has been developed by Kayne(1979), Jaeggli(1980, 1982), Aoun, Hornstein and Sportiche(1981) and others in pursuit of GB.

2 The felicitous answer to (2) must be of the form seen in (i) in case of the narrow scope
For comparison with other principles treated in this paper, (5) can be restated, with no empirical difference, as an S-structure condition: In a multiple wh-construction, where a wh-phrase is in COMP, and another is in situ, the S-structure trace of the phrase in COMP must c-command the S-structure position of the wh-in-situ.

Although this condition gives the correct result, it is unsatisfactory because of the ad hoc nature involved in it: it is hard to understand why the wh-in-situ should have to bear some particular relation to the original position of the wh-phrase in COMP. If, however, it is possible to derive this apparently ad hoc constraint from a notion that is more deeply integrated in the system of grammatical principles, this disadvantage would disappear. Many GB-grammarians have frequently observed that superiority effects can be reduced to a more generalized principle under the assumption that wh-in-situ does move at LF. In short, given LF representation for each sentence in (4), then a linguistically significant principle applying to it may explain the difference in grammaticality between the two sentences. In particular, Chomsky(1981, 1986) and Lasnik & Saito(1984) propose, in a slightly different way from each other, that the ECP applying to LF may account for superiority effects resulting from multiple wh-constructions. Besides, Pesetsky(1982) argues that superiority effects can be explained in terms of what he calls the path containment condition(PPC), and Aoun(1986) argues that an approach which incorporates the generalized binding theory(GBT) is superior to an approach where the superiority effects are accounted for by the ECP.

In section 2, I will explore how the major principles suggested in the GB-framework as alternatives to (5) operate on multiple wh-constructions in English with respect to superiority effects, and further consider what problems are raised from them on empirical grounds. Moreover, in section 3, I will demonstrate that an S-structure principle for the scope interpretation of wh-in-situ can make correct predictions about superiority effects resulting from multiple wh-constructions in English under the partial interaction with principle(C) of the binding theory, without reference to the assumption of abstract wh-movement at LF.

---

(i) John knows where we bought what.
(ii) John knows where we bought the book; Mary knows where we bought the bag.
2. Three LF Approaches to Superiority Effects and their Problems

2.1. On the Empty Category Principle

Along the line of Chomsky(1986), we have the following statement of the ECP:

(6) A nonpronominal empty category must be properly governed.

Chomsky(1986:17) further defines the notion of proper government as follows:

(7) \( a \) properly governs \( \beta \) iff \( a \) \( \theta \)-governs or antecedent-governs \( \beta \).

In particular, an object is \( \theta \)-governed, and hence properly governed, by its head, but a subject or adjunct can only be properly governed in a chain by antecedent government, so that subjects and adjuncts should in general behave alike under the ECP.

To show this in concrete terms, let us consider the contrast between the following examples.

(8) a. Who admires what?
   b. *What does who admire?

Chomsky(1986) does not work out the specific mechanisms of LF-movement of \( wh \)-in-situ, but it is clear from (8) that they must have the property that the \( wh \)-phrase fronted at LF occupies a position in which it does not govern its trace; thus, (8b), which does require antecedent-government of the trace of \( who \) at LF, is barred, whereas (8a), which does not require antecedent-government of the trace of \( what \), since it is \( \theta \)-governed by \( admire \), is grammatical. Therefore, it is natural that Chomsky’s version of the ECP should have to be strengthened with May’s(1985) assumption that multiple \( wh \)-constructions, at LF, involve adjunction to \( wh \)-phrase in

\footnote{Chomsky (1986) further defines the notions of government. \( \theta \)-government and antecedent-government respectively as follows:
(i) \( a \) governs \( \beta \) iff \( a \) m-commands \( \beta \) and there is no \( \gamma \), \( \gamma \) a barrier for \( \beta \), such that \( \gamma \) excludes \( a \).
(ii) \( a \) \( \theta \)-governs \( \beta \) iff \( a \) is a zero-level category that \( \theta \)-marks \( \beta \), and \( a \), \( \beta \) are sisters.
(iii) \( a \) antecedent-governs \( \beta \) iff (a) \( a \) governs \( \beta \) and (b) \( a \) is coindexed with \( \beta \).
See Chomsky(1986) for further discussion of the notions of barrier, m-command, and exclusion.}
According to this assumption, after LF wh-movement, each of the above examples has the following representation under Chomsky’s (1986) extension of X-bar notation for the lexical categories to the nonlexical ones.

(9) a. 

In (9a), the trace of what, $t_p$, is $\theta$-governed and hence properly governed by admire and the trace of who, $t_b$, furthermore antecedent-governed by NP in the SPEC of CP. Thus, there arises no violation of the ECP in (9a). Therefore, we correctly predict that (8a) is grammatical. On the other hand, given (9b), the ungrammaticality of (8b) straightforwardly follows
from the violation of the ECP. Although the initial trace of \textit{what}, \( t_j \), is \( \theta \)-governed by \textit{admire}, as in (9a), or antecedent-governed by the intermediate trace, \( t_j' \), where it is not deleted at LF by Affect-\( \alpha \),\(^4\) and moreover, \( t_j' \) can be also antecedent-governed by \( \text{NP}_j \) in the SPEC of CP, the trace of \textit{who} in the subject position cannot be antecedent-governed by \( \text{NP}_i \), which is adjoined to \( \text{NP}_j \) as the result of LF \textit{wh}-movement, since Chomsky\((1986, 87 \text{ and fn. 48})\) consequently proposes that antecedent-government requires not merely m-command but the stronger requirement of c-command in the sense of Reinhart\((1976)\). In short, in (9b), \( \text{NP}_i \) m-commands \( t_i \) since the first maximal projection dominating \( \text{NP}_i \), that is, CP, dominates \( t_i \),\(^5\) but \( \text{NP}_i \) does not c-command \( t_i \) since the first node dominating \( \text{NP}_i \), that is, \( \text{NP}_j \) in the SPEC of the CP, does not dominate \( t_i \). Hence, (9b) leads to the violation of the ECP. Therefore, we correctly predict that (8b) is ungrammatical.

Returning now to the examples in (4), each of them, after LF \textit{wh}-movement, has the following representation:

\[(10) \ a. \ [\text{CP} \ [\text{NP}_i \ \text{what}_i \ \text{who}_i] \ [\text{IP} \ \text{does} \ \text{Mary} \ [\text{VP} \ t_i'' \ [\text{VP} \ \text{expect} \ [\text{CP} \ t_i' \ [\text{IP} \ t_i \ [\text{VP} \ \text{bought} \ t_i']]]]]]] (\text{derived from (4a)})
\]
\[(10) \ b. \ [\text{CP} \ [\text{NP}_i \ \text{who}_i \ \text{what}_i] \ [\text{IP} \ \text{does} \ \text{Mary} \ [\text{VP} \ t_i' \ [\text{VP} \ t_j'' \ [\text{VP} \ \text{expect} \ [\text{CP} \ t_j'' \ [\text{IP} \ t_i \ [\text{VP} \ t_j' \ [\text{VP} \ \text{bought} \ t_j']]]]]]] (\text{derived from (4b)})\]

In (10a), the initial trace of \textit{who}_i, \( t_i \), is antecedent-governed by \( t_i' \) in the SPEC of the embedded CP, which is also antecedent-governed by \( t_i'' \) adjoined to the matrix VP, in which case VP is not counted as a barrier for \( t_i' \) (see Chomsky (1986)), and moreover, \( t_i'' \) is antecedent-governed as observed above. Furthermore, the trace of \textit{what}_i, \( t_j \), is \( \theta \)-governed and hence properly governed by \textit{bought}, even if it is not antecedent-governed by its antecedent \textit{what}_j. On the other hand, given (10b), the ungrammaticality of (4b) is due to the violation of the ECP. Although the initial trace of \textit{what}_j, \( t_j \), is either \( \theta \)-governed by \textit{bought} or antecedent-governed by \( t_j' \) adjoined to the embedded VP, which is further permitted either to be antecedent-governed by \( t_j'' \) at S-structure or to be deleted by Affect-\( \alpha \) at LF, and likewise in the

\(^4\) According to Lasnik & Saito\((1984)\), the rule of Affect-\( \alpha \), defined in (i), applies, before \( \gamma \) feature assignment for checking of proper government at LF, twice in D-structure and in LF component.

\[(i) \ (a) \ \text{optionally move anything anywhere, subject to Subjacency, creating a trace or not}
\]

\[(b) \ \text{optionally delete or insert anything lacking semantic content (e.g. of, that, it, t).}\]

\(^5\) Along the line of May\((1985)\), Chomsky\((1986:7)\) defines the notion of domination concerning adjunction structure as follows:

\[\alpha \text{ is dominated by } \beta \text{ only if it is dominated by every segment of } \beta.\]
cases of $t_i''$ and $t_i'''$, the initial trace of $who_i$, $t_i$, cannot be antecedent-governed by either its antecedent $t'_i$ or $who_i$, even though $t'_i$ is adjoined to the matrix VP, since the embedded CP category, a barrier for $t_i$, is blocking government from outside. Thus, we correctly predict that (4a) is grammatical but (4b) is not.

A descriptively significant consequence resulting from the ECP concerning multiple wh-constructions in English is that wh-in-situ occurring in a $\theta$-governed position is always permitted to move anywhere for their scope interpretation at LF, whereas wh-in-situ in an un-$\theta$-governed position cannot undergo LF wh-movement, in which case an ECP violation arises exclusively.

According to this consequence, the same conclusion also follows from consideration of the contrast between (11a) and (11b).

(11) a. Who knows how John did what?
   b. *Who knows what John did how?

In (11a), wh-in-situ what may have either narrow scope or wide scope, since it can be freely moved to the matrix CP or to the embedded CP regardless of antecedent-government because it is guaranteed for $\theta$-government by the lexical head did. On the other hand, how in (11b) cannot be moved to any CP; otherwise, the original trace of how is left as an offending trace with respect to the ECP.

Thus, the superiority effect concerning (11) reduces to the effect of the ECP.

In what follows, let us explore some problems crucially resulting from the application of the ECP to multiple wh-constructions in English. Though certain superiority effects can be, as we have seen, accounted for directly by the ECP, some other cases cannot be.

The contrast between each following pair of examples illustrates such a "pure" superiority phenomenon that cannot be accounted for by the ECP. Note that the judgement of the grammaticality in (12) through (14) is due to May (1985).

Along with Lasnik & Saito's (1984) assumption, Chomsky (1986) proposes that the intermediate traces of wh-phrases initiated from A-positions may be, if necessary, deleted by Affect-\(a\), whereas the traces of adjuncts must be retained until LF, since checking of proper government for them takes place after Affect-\(a\) in the LF component as opposed to the cases of arguments. Nevertheless, the traces resulting from LF wh-movement, whether adjunct traces or not, must be retained for checking of proper government for them at LF, since in each component Affect-\(a\) takes place before checking of proper government.
(12) a. I wondered who to persuade to read what books.
    b. *I wondered what books to persuade who to read.
(13) a. Who does Mary expect to buy what?
    b. *What does Mary expect who to buy?
(14) a. Who did you tell about what topic?
    b. *What topic did you tell who about?

In each case of (12-14), the contrast between (a) and (b) cannot fall under the effect of the ECP, since for both wh-phrases in each sentence, whether they undergo wh-movement at LF or at S-structure, their original traces appear in the \( \theta \)-governed position and hence there arises no violation of the ECP. Nevertheless, in each pair of examples, (a) is grammatical whereas (b) turns out to be ungrammatical, as opposed to the prediction of the ECP.

Let us now consider different sorts of counter-examples against the ECP, excerpted from May (1985).

(15) a. *Who does Dulles believe that who suspected?
    b. ?Who believes that who suspected Philby?
(16) a. *What did who admire?
    b. ?What did who admire where?

From the perspective of the ECP, there should be no difference between (a) and (b) in each case of (15) and (16), since in both the (a) and the (b) examples a wh-phrase who occurs in the subject position, which is an un-\( \theta \)-governed position, and LF extraction from this position will lead to the violation of the ECP.\(^7\)

Nevertheless, the cases with no superiority violation (i.e., (17b)) and with another added wh-phrase (i.e., (16b)) are considerably better than the opposite cases (i.e., (15a) and (16a)) respectively.

These incorrect predictions concerning superiority effects, as we have seen above, are assumed to be because the ECP makes absolutely no reference to the notion of proper government.

2.2. On the Path Containment Condition

As a starting point, note that it is worthwhile to see if some other gener-

---

\(^7\) Lasnik & Saito (1984: 274) propose that the improved status of (15b) is due to a "marked" case of proper government by INFL, which is assumed to move into COMP at LF. But this proposal cannot still discriminate between (a) and (b) in each case of (15) and (16).
alized condition applied to LF representation might account more naturally for the full range of superiority phenomena we have been investigating with regard to multiple wh-constructions in English. As an alternative to the ECP, a syntactic well-formedness condition argued extensively by Pesetsky (1982) is in order. He suggests that the structures involving multiple A-bindings must satisfy what he calls the Path Containment Condition (PCC). It may be stated loosely as follows:

(17) Intersecting A-categorial paths must embed, not overlap.

To see the effect of the PCC, consider the contrast in grammaticality between the examples in (8); recall that (8b) was purportedly ruled out by the ECP because Chomsky-adjunction of NP_i to NP_j blocked proper government, that is, antecedent-government for its trace i in the subject position. The relevant LF representations for them are shown in (9) respectively. Although such a representation is in the sense of Chomsky (1986), it is also applicable to the PCC just as it is.

In each case of the LF representations in (9), the relevant categorial paths of the wh-phrases can be indicated as follows:

(18) (in the case of (9a))
path(who) = \( (IP, Č, CP) \)
path(what) = \( (VP, Ġ, IP, Č, CP, NP_j) \)

(19) (in the case of (9b))
path(who) = \( (IP, Č, CP, NP_j) \)
path(what) = \( (VP, Ġ, IP, Č, CP) \)

In (19), the paths illicitly overlap, violating the PCC. This contrasts with (18), in which the paths properly embed. Bear in mind that in evaluating path structure it is presumed that the higher occurrence of the NP to which the LF-moved wh-phrase has been adjoined—NP_i in (9a) and NP_j in (9b)—is sufficient to terminate a path. Thus, superiority effects concerning multiple wh-constructions reduce to the effect of the PCC.

Pursuing this line of analysis, recall the problem with an ECP account of superiority—namely, that there are apparent superiority effects that do not seem to fall under the ECP. They were illustrated in (12) through (16).

To take examples, let us consider the LF representations of both (a) and (b) in each case of (13) and (15) with their associated path structures. They are roughly expressed in accordance with the PCC respectively as follows:
Given the PPC, these cases are distinguished as desired. In (20a) the
categorial path from \( t_i \) to the phrase that binds it is properly embedded in
the path from \( t_i \) to its binder, a circumstance that fails to obtain in (20b). In
the latter case, the paths overlap rather than embed, and thus this repre-
sentation is correctly predicted to be ill-formed under the PCC. Exactly the
same path structures are to be found in (12a,b) and (14a,b), as May(1985)
oberves. As is required, the same conclusion follows from the case of (21).
What seems to be crucial in the contrast between (21a) and (21b) is not the
notion of proper government but the relation of the binding paths found at
LF; in (21a) the paths overlap, whereas in (21b) they embed, and it is just
this distinction to which the PCC, but not the ECP, is sensitive.

In what follows, let us, however, consider certain problems with the PCC.
As we know, an apparent consequence resulting from the effect of the PCC
is that at S-structure the trace left by \( wh \)-movement must c-command (in the
sense of Reinhart(1976)) the \( wh \)-in-situ; otherwise, a violation of the PCC
might arise.

At this juncture, let us observe how the PCC operates on the multiple
\( wh \)-construction with \( why \)-questions (and similarly \( how \)-questions).

(22) a. *Why/How does who believe Harry?
b. *Who believes Harry why/how?

Note that the ungrammaticality of the above examples falls under the anal-
sis via the ECP, since each example has one wh-in-situ in the un-θ-governed position. However, the PCC cannot account for their ungrammaticality without some elaboration of the assumptions about the basic phrase structure configuration of English, since in both sentences that trace left by syntactic wh-movement c-commands the wh-in-situ they contain and hence the associated path structure is compatible with the effect of the PCC.

Suppose that the ungrammaticality of (22a) is attributed to the violation of the PCC. It would follow that the trace of why must not c-command who at S-structure. It is possible only under the assumption that sentence adverbs like why are immediately dominated by İ(INFL‘) rather than by IP(INFL” or S) at D-structure, as different from subjects. If so, we can get an illicit path structure from the LF representation of (22a) and consequently the ungrammaticality of (22a) is subsumed under the effect of the PCC.

The associated paths are represented under this assumption as follows:

\[(23) \text{path(why) } = (İ, IP, CP)\]
\[\text{path(who) } = (IP, CP, ADV)\]

Given the assumption about sentence adverbs, an unwanted result now follows from the case of (22b). In (22b) the trace left by wh-movement c-commands wh-in-situ at S-structure and hence there is no violation in the path structure associated with its LF representation. Nevertheless, (22b) is quite ungrammatical.\(^8\)

Furthermore, given that where and when are assumed to be sentence adverbs as analogous to why and how, the PCC also fails to account for the contrast of grammaticality between following examples:

\[(24)\]
\[a. \text{Who bought a book where/when?} \]
\[b. *\text{Who bought a book how/why?}\]

Notice that (24a) and (24b) give rise to the same path structure in which the associated paths embed, not overlap, in accordance with the PCC. Nevertheless, (24b), unlike (24a), turns out to be ill-formed as opposed to the

\(^8\) For (22b), another possibility is in order, as independent of path structure, as May(1985) observes. It may be that the source of the deviance lies in the following general condition on modification:

(i) At LF, modifiers must govern the constituent they modify.

According to (i), any sentence with wh-in-situ in the adjunct position turns out to be ill-formed, since LF wh-movement produces an adjunction-structure in COMP where the LF-moved wh-adjunct fails to govern S(IP) it modifies.
prediction of the PCC.

Note that Pesetsky (1982) argues in detail that an INFL-COMP path is necessary in accounting for "that-trace" effects. If this path is relevant to the PCC at LF, it would incorrectly predict that (15a), *who does Dulles believe that who suspected, and (15b), ?who believes that who suspected Philby, should be equally ill-formed, likewise in the ECP, since the path of the embedded subject who and the path of INFL-COMP overlap in the path structure at LF, as shown in (25).

\[(25) \text{path(} \text{embedded who}) = (\text{IP, CP, VP, IP, CP, NP}) \]
\[\text{path(} \text{INFL-COMP}) = (I, \text{IP, CP}) \]

Another problem with the PCC arises from the contrast between the following examples.

(26) a. *Who does John believe that pictures of surprised whom? 
b. ?Who does John believe that pictures of whom surprised?

Notice that (26a) falls under the effect of the so-called subject condition, which proscribes extraction from subject NP. However, the PCC does not distinguish between the examples. Under the PCC, (26b) should be as ill-formed as (26a), since neither (26a) nor (26b) contains a well-formed path structure in its LF representation, as shown in (27) respectively.

(27) a. path(who) = (NP, IP, CP, VP, IP, CP) 
   path(whom) = (NP, IP, CP, VP, IP, CP) 
b. path(whom) = (NP, IP, CP, VP, IP, CP, NP) 
   path(who) = (NP, IP, CP, VP, IP, CP, NP) 

Returning to (12), let us compare it with the following pair of examples, cited from Pesetsky (1984). An unwanted problem with the PCC also arises.

(28) a. Which man did you persuade to read which book? 
b. Which book did you persuade which man to read?

As is observed, the case of (12) falls under the effect of the PCC. However, both examples in (28) that are assumed to contain just the same path structures as in their counterparts of (12) have a lack of superiority effects, as opposed to the prediction of the PCC.
2.3. On the Generalized Binding Theory

As is well-known, Aoun(1986) argues that the ECP effects such as 'superiority' may be subsumed under the effect of the generalized binding theory (GBT). In particular, he shows that there are two kinds of anaphoric relations: A-anaphor and Ā-anaphor, and proposes that the binding principle for A-anaphor is extended to Ā-anaphor under the GBT. The GBT is defined as follows:

(29) Generalized Binding Principle
A. An anaphor must be X-bound in its governing category.
B. A pronominal must be X-free in its governing category.
C. An R-expression must be A-free.
   (where X = A or Ā)

The definition of governing category and its subsidiary notion of accessibility are also formulated as follows: (See Aoun (1986) for further discussion.)

(30) a is a governing category for β iff a is the minimal maximal projection (i.e., S or NP) containing β and a SUBJECT accessible to β.

(31) a is accessible to β iff β is in the c-command domain of a and coindexing of (a, β) would not violate any grammatical principle.

To make it clearer, let us observe how the GBT accounts for superiority effects with respect to multiple wh-constructions in English. A pair of typical examples is in order:

(32) a. Who saw what?
b. *What did who saw?

Along the lines of Aoun (1985), we assume the LF representations of the above sentences to be as in (33) respectively.9

---

9 Aoun (1986: 99) suggests the following COMP indexing rule, which is assumed to apply freely without any restriction at S-structure, as slightly different from Lasnik & Saito (1984).

(i) COMP indexing rule

\[ [\text{COMP} \to X^0, \ldots] \to [\text{COMP}, \ldots, X^0, \ldots] \]
Recall that this types of superiority effects was properly accounted for by either the ECP or the PCC, as exploited above.

According to the effect of the GBT, wh-traces, which are A-anaphor, must be bound by their antecedents in COMP in their governing category. In (33a), $t_i$ is bound by COMP$_i$ in $S$, which is its governing category, but $t_j$ is not bound. Nevertheless, (33a) turns out to be well-formed. It follows from a virtue of the GBT that the binding theory is irrelevant to the wh-trace in object position. Notice that the variable in object position does not have an accessible SUBJECT; hence it has no governing category, and the binding theory cannot apply. The reason is that since each AGR is coindexed with a subject, coindexing of any of these AGR with the variable would violate principle (C) of the binding theory. Therefore, there is no violation of the GBT in (33a); hence (32a) turns out to be grammatical under the effect of the GBT. On the other hand, a violation of the GBT arises from (33b).

Here $t_i$ is an offending A-anaphor, since it cannot be bound by its antecedent who$_i$ in $S$, which is defined as its governing category by (30), under the system that COMP is coindexed with what$_i$ at S-structure prior to LF movement of who$_i$. Thus, (33b) proves to be ill-formed under the GBT although $t_j$ is OK, likewise in (33a).

As expected, the contrast in grammaticality between the examples in (32) falls under the GBT.

At this juncture, let us see if the GBT may account for multiple wh-constructions with a wh-adjunct that stays in situ, as shown in (34).

(34) a. Why/How did John buy what?
   b. *What did John buy why/how?

Each of the examples has LF representation after LF wh-movement as follows:

(35) a. $[s [\text{COMP}_i \text{ what}_i \text{ why}_i] [s \text{ John buy } t_j t_i]]$
   b. $[s [\text{COMP}_j \text{ why}_i \text{ what}_j] [s \text{ John buy } t_j t_i]]$

According to Aoun (1986), although wh-trace in the subject position of tensed clause is a variable as in the object position, it may take a governing category as different from the one in object position, since coindexing of it with AGR in the same clause violates no principle.
There is no violation of the GBT in (35a), as in (33a), in that here \( t_i \) is bound by \( whyj \) in its governing category \( \hat{S} \) and in the case of \( t_j \) the binding theory does not apply as observed above. On the other hand, in (33b), the GBT is not satisfied. Now, \( t_i \) is shown as an offending trace regardless of \( t_j \), since the adjunct-trace should fall under the GBT in that it may be assigned a governing category by (30) along with Aoun's (1986) assumption that the \( wh \)-trace in \( A \)-position is anaphor but not variable and hence coindexing of it with AGR violates no principle, in which case the AGR serves as a legitimate SUBJECT accessible to it. Nevertheless, \( t_i \) does not have any-antecedent binding it in its governing category. Thus, (34b) turns out to be ill-formed under the GBT.

As we observe, the GBT, to a certain extent, makes correct predictions about multiple \( wh \)-constructions with regard to superiority effects.

From the perspective of the GBT, it follows that only accusative Case-marked \( wh \)-phrases can stay in situ at S-structure but others cannot. In short, the \( wh \)-trace in object position is free from the effect of the GBT, since the binding theory is irrelevant to it as explored above. On the other hand, the \( wh \)-traces in adjunct and subject positions in a tensed clause should fall under the GBT, since they are assigned a relevant governing category. Hence, if a \( wh \)-phrase occurs in subject position of the tensed clause or in adjunct position at S-structure, its LF trace violates the GBT, since it cannot have an antecedent that binds it.

Given this consequence, most of the counter-examples against the ECP, as cited above, provide empirical evidence against the GBT as well. Returning to (12-14), let us consider the LF representation of each example in (13) for instance. In the sense of Aoun(1986), it is shown as follows:

\[(36) \ a. \ [\hat{S} [\textsc{comp}j \text{ what}_i \text{ who}_j] [S \text{ Mary expect } [S \text{ t}_i \text{ to buy } t_j]]] \\
 b. \ [\hat{S} [\textsc{comp}j \text{ who}_i \text{ what}_j] [S \text{ Mary expect } [S \text{ t}_i \text{ to buy } t_j]]]
\]

In each representation of (36), both \( wh \)-traces, \( t_i \) and \( t_j \), are variables that occur in accusative Case-marked position, and hence, the binding principle is irrelevant to both case of \( t_i \) and \( t_j \), since neither \( t_i \) nor \( t_j \) is assigned a governing category; indexing of them with the matrix AGR gives rise to the violation of principle (C) of the GBT. Thus, the contrast of grammaticality between (13a) and (13b) cannot be accounted for by the GBT either; under the effect of the GBT, both sentences should turn out to be well-formed.

Now, let us see how the GBT operates on the examples in (15) and (16). For convenience, consider the case of (15) for instance.

Each of the examples in (15) have LF representation as follows:
In each representation of (37), \( t_i \) does not violate the GBT, and further \( t_j \), the initial trace of \( \text{who}_i \), satisfies the GBT as well, since it is bound by its antecedent \( t'_j \) in its governing category, that is, the embedded \( S \). However, \( t'_j \) in the embedded COMP gives rise to a problem with the GBT in each case in that \( t'_j \), occurring in A-position, is anaphor but not variable like an adjunct-trace, and so it should be bound in the matrix \( S \) that is defined as its governing category by (30). Neither in (37a) nor in (37b), is \( t'_j \) bound. Therefore, it proves to be an offending trace according to the prediction of the GBT. Nevertheless, (15b) turns out far more acceptable than (15a). Accordingly, we conclude that the problem with the ECP concerning wh-in-situ in subject position still remains unsolved under the GBT.

3. Principle of Scope-Binding and Superiority Effects

In this section, I will propose the principle of scope-binding (PSB), which is an alternative to the LF movement approach to the scope interpretation for wh-in-situ appearing in multiple wh-constructions in English. In particular, this principle is assumed to apply at S-structure instead of LF representation. Therefore, it will be argued that the PSB, without recourse to LF movement, subsumes all effects such LF constraints as the ECP, the PCC and the GBT have or do not have concerning multiple wh-constructions in English, under the interaction with an extension of the binding principle (C). In short, the PSB accounts for the phenomena of superiority effects concerning multiple interrogation in English at S-structure with the aid of the principle of the binding theory.

The PSB is formulated as follows:

(38) Wh-in-situ must be scope-bound.

The notion of scope-binding is defined as follows:

(39) \( a \) is scope-bound by \( \beta \) iff \( a \) is bound by \( \beta \), where \( \beta \) is the [+WH] head of CP that \( a \) takes as its relevant scope.
The relevant scope, in terms of which the above definition is expressed, implies the scope resulting from quantification of wh-in-situ, according to which it has either wide scope reading or narrow scope reading. The notion of relevant scope and the notion of scope-compatible [+WH] COMP are defined as in (40) and (41) respectively:

(40) $a$ is the relevant scope for $\beta$ iff $a$ is the minimal CP($\bar{S}$) that contains $\beta$, a lexical governor of $\beta$ and a scope-compatible [+WH] COMP for $\beta$.

(41) $a$ is scope-compatible [+WH] COMP for $\beta$ iff $a$ is [+WH] COMP and coindexation of $\beta$ with $a$ violates no principle.

What the above definitions imply is that the scope of wh-in-situ is represented by indexation of it with [+WH] COMP but not by LF movement of wh-in-situ.

According to this implication, the scope ambiguity in (2) will result from the two coindexing possibilities for what. The narrow scope interpretation results from coindexation with the lower [+WH] COMP, seen in (42a) below; the wide scope interpretation results from coindexation with the higher [+WH] COMP, seen in (42b) below:

(42) a. $[\text{CP whom}_i [\text{c [+WH]}][\text{IP t}_j \text{ knows } \text{CP where}_j [\text{c [+WH}]^k[\text{IP we bought } \text{what}_k \text{ t}_j]]]]$

b. $[\text{CP who}_i [\text{c [+WH]}][\text{IP t}_j \text{ knows } \text{CP where}_j [\text{c [+WH]}^k[\text{IP we bought } \text{what}_k \text{ t}_j]]]]$

Notice that the coindexation for scope interpretation assigns a superscript to [+WH] COMP; the position for subscript is reserved for another indexation by SPEC-head agreement in the sense of Chomsky(1986). For example, the matrix [+WH] COMP in (42b) is fully specified as [+WH]$^k_i$ after two kinds of indexation have been applied.

Let us now investigate how the PSB account for superiority effects concerning multiple wh-constructions in English.

First of all, consider the following example with regard to the definition of (40).

(43) Who knows which pictures of whom Bill bought?

An issue raised by (43) is why the wh-in-situ whom has only wide scope reading; (43) is construed as a multiple direct question but not as a multiple
indirect question, due to Van Riemsdijk & Williams (1981). The solution follows from the virtue of (40). That is, the embedded CP cannot be the relevant scope for whom in (40), since it does not contain a scope-compatible [+WH] COMP although it contains whom and the lexical governor of whom, i.e., pictures or of; coindexation of whom with the embedded [+WH] COMP gives rise to violation of so-called “i-within-i” condition and hence the embedded [+WH] COMP cannot be scope-compatible for whom. On the other and, the matrix CP can be a relevant scope for whom in (43), since it contains whom, a lexical governor of whom and a scope-compatible [+WH] COMP for whom, which is the matrix [+WH] COMP. Furthermore, whom comes to be scope-bound by the matrix [+WH] COMP in the matrix CP. Thus, the PSB correctly predicts that (43) is grammatical only when it is construed as a multiple direct question.

Returning to (4), let us see how superiority effects concerning multiple wh-constructions are accounted for by the PSB. Each example in (4) has S-structure after indexation as shown in (44).

\[(44)\]

\[a. \left[ cp \, wh_0 \left[ e \left[ e_1 \left[ ip \text{ Mary expect } \left[ cp \left[ ip \, t_i \text{ bought what}_i \right]\right]\right]\right]\right]\right]\]

\[b. \left[ cp \, what_j \left[ e \left[ e_1 \left[ ip \text{ Mary expect } \left[ cp \left[ ip \, \text{wh}_i \text{ bought } t_j\right]\right]\right]\right]\right]\right]\]

No violation arises from (44a); what, wh-in-situ, is scope-bound by [+WH] COMP that is scope-compatible with it in its relevant scope, the matrix CP, and further \(t_i\) satisfies various conditions on it, that is, the ECP, Subjacency, the binding principle, etc.\(^1\) Thus, the interaction of various principles guarantees that (4a) is grammatical. It seems reasonable to assume that the decision of grammaticality results from the interaction of various principles concerned with it in the modular system of grammar. On the other hand, in (44b), \(who_i\) satisfies the PSB under an extension of proper governor,\(^\text{i}\)

\(^1\) Coindexation of whom with the embedded [+WH] COMP leads to violation of “i-within-i” condition, since which pictures of whom in SPEC position of the embedded CP is also coindexed with the embedded [+WH] COMP by SPEC-head agreement in the sense of Chomsky(1986), and hence the index of whom is equal to the index of which pictures of whom as a result of two independent indexations.

\(^\text{i}\) Along the lines of Chomsky(1986), we assume that various locality conditions defined in terms of barriers apply, in the same way as in Chomsky(1986), to empty categories occurring at S-structure by Move-\(a\).

\(^\text{13}\) In Stowell(1981), [+Tense] morpheme is assumed to occur in the head of tensed CP (i.e., in COMP of tensed clause) and to assign nominative Case to the subject by rightword government at S-structure. Given this assumption, it is not unreasonable to assume that [+Tense] morpheme is qualified as a kind of lexical governor, although not strong but weak, to the subject. Hence, we assume that under the PSB [+Tense] morpheme only in [−WH] COMP serves as a weak lexical governor for wh-in-situ in the subject position.
however, from a consequence of the PSB, \( t_i \) leads to principle(C) of the binding theory. That is, \( t_i \) is A-bound by \( \text{wh-in-situ, who}_j \), in the (c-)domain of the head of its chain under the assumption that the index \( i \) equals the index \( j \) in the situation \([A]^i_j\) as a result of coindexation. Thus, (44b) is barred, as expected, by the requirement that the A-bound trace (i.e., variable) must be A-free in the domain of the head of its chain, a subcase of principle(C) of the binding theory. Accordingly, the contrast in grammaticality between (4a) and (4b) is attributed to the effect of the PSB.

Returning to (22), let us now consider \textit{why/how}-questions in multiple \textit{wh}-constructions from the perspective of the PSB.

Each example in (22), after coindexation, has S-structure as shown in (45).

\begin{align*}
\text{(45) a. } & [\text{cp why/how}_i [\text{c} [+WH]_j [\text{ip who}_j \text{believe Harry } t_j]]] \\
\text{b. } & [\text{cp who}_j [\text{c} [+WH]_j [\text{ip } t_j \text{believe Harry why/how}_i]]]
\end{align*}

As is required, the ill-formedness of these syntactic representations is straightforwardly due to the violation of the PSB; in (45a) \textit{who}_j has no lexical governor and hence is not assigned its relevant scope in which it must be scope-bound, and on the other hand, in (45b), \textit{why/how}_i has no lexical governor and hence results in the violation of the PSB as in the case of \textit{who}_j in (45a). Thus, the ungrammaticality of each example in (22), as observed, falls under the effect of the PSB.\(^{15}\)

Let us now return to the examples from which certain empirical problems with the ECP have resulted. At first, consider the case of "pure" superiority phenomena seen in (12-14). Take (12) for instance. The S-structure of each example is represented as in (46) after coindexation.

\(^{14}\) Nevertheless, \textit{wh-in-situ} in (44a), \textit{what}_i, is insensitive to the index equation resulting from coindexation although it is also a kind of R-expression, which falls under principle(C) of the binding theory. Accordingly, it follows that name, unlike variable, is responsible to no more than an actual referential index with respect to the binding theory.

\(^{15}\) Compare the case where/when-questions in (i) with the case of why/how-questions in (22b).

(i) Who believes Harry where/when?

In contradiction to (22), (i) is grammatical in spite of \textit{where/when} in adjunct position. However, given Huang's (1982) assumption that \textit{where/when} occurs in the complement position of PP the head of which is the null preposition \([p, \#] \), \textit{where/when} may be assigned a relevant scope to the extent that the null preposition is assumed as a lexical governor to it. \textit{Why/how} is distinguished from \textit{where/when} in this respect; it is no more than adjunct.
(46) a. I wondered [CP whoi [c [+WH]i [IP PRO to persuade tij [CP
[IP PRO to read what book]]]]]
   b. I wondered [CP what bookj [c [+WH]j [IP PRO to persuade whoi,
[CP [IP PRO to read tij]]]]]

In each representation, wh-in-situ satisfies the PSB; it is bound by [+WH] COMP that is scope-compatible with it in its relevant scope. Hence, there is no violation of the PSB in either case. Nevertheless, (46b), unlike (46a), turns out ill-formed, since in (46b) tij, a variable, is A-bound in the domain of the head of its chain and hence leads to the violation of principle (C) of the binding theory, as distinct from the case of tij in (46a). Therefore, the constrast in grammaticality between the examples in (12) is due to the binding theory interacted with the PSB.

Now, returning to more interesting cases, (15) and (16), let us see how they are accounted for under the effect of the PSB.

Each sentence in (15) has the following representation of S-structure, after coindexation:

(47) a. [CP whoi [c [+WH]i [IP Dulles believe [CP [+Tense] [IP whoj
suspect tij]]]]]
   b. [CP whoi [c [+WH]i [IP tij believe [CP [+Tense][IP whoj suspect
Philby]]]]]

Notice that the contrast in grammaticality between the examples in (15) has fallen far beyond the range of the ECP. However, as is expected, it is straightforwardly explained under the PSB in the interaction with the binding theory.

In each representation of (47), whoj gives rise to no violation of the PSB; it is scope-bound in the matrix CP, which is defined as its relevant scope by (40) to the extent that [+Tense] is assumed to be a lexical governor to it. Nevertheless, (47a), unlike (47b), turns out to be ill-formed, since tij in (47a) violates principle (C) of the binding theory as distinct from tij in (47b); it is A-bound by whoj as a result of equation of indices (i.e., i = j) after coindexation whereas tij in (47b) is locally A-bound by its antecedent whoi in the matrix COMP.

On the other hand, each sentence in (16) has the following representation of S-structure after coindexation.

(48) a. [CP whati [c [+WH]i [IP whoj admire tij]]]
    b. [CP whati [c [+WH]i/k [IP whoj admire tij wherek]]]
From the perspective of the PSB, (48a) turns out to be ill-formed; who_{i} has no lexical governor to it and hence there is no relevant scope for wh-in-situ in (48a). Even though we regard the tense-bearer did appearing in COMP of the matrix interrogative clause as another sort of lexical governor to subject, in this case t_{i} in (48a) violates principle(C) of the binding theory, as observed above.

On the other hand, the situation is completely reversed in (48b); there is a relevant scope for wh-in-situ, the matrix CP, which is assigned to where_{k} but in which who_{j} is contained. It does not seem unreasonable to assume that every wh-in-situ that is contained in a relevant scope assigned for another wh-in-situ takes it as its own relevant scope. Given this assumption, who_{i} in (48b) takes the matrix CP as its relevant scope. Otherwise, who_{i} in (48b) is assigned the same relevant scope that where_{k} has under the assumption that the tense-bearer did in the matrix COMP is a sort of lexical governor to it. In any case, in (48b), where_{k} and who_{j} are assumed to be scope-bound and hence satisfy the PSB. Furthermore, as distinct from the case of (48a), t_{i} in (48b) no longer violates principle(C) of the binding theory, since t_{i} is bound neither by who_{j} nor by where_{k}; the equation of indices in this case is precisely i = j/k but neither i = j nor i = k. As required, t_{i} in (48b) is locally Â-bound by its antecedent what_{i}. Thus, the contrast in grammaticality between the examples in (16) also falls under the effect of the PSB in the interaction of the binding theory.

Returning to the examples from which certain empirical problems with the PCC arose, let us consider first the contrast between the examples in (26). The relevant S-structure of each example is as follows:

\[
\begin{align*}
\text{(49) a. } & \left[\text{CP who}_{i} \left[\text{c \ [+WH]_{i}} \left[\text{IP John believe \[CP} \left[\text{IP pictures of t}_{i} \left[\text{surprised whom}_{j}\right]\right]\right]\right]\right]\} \\
\text{b. } & \left[\text{CP who}_{i} \left[\text{c \ [+WH]_{i}} \left[\text{IP John believe \[CP} \left[\text{IP pictures of whom}_{j} \left[\text{surprised t}_{i}\right]\right]\right]\right]\right]\}
\end{align*}
\]

As a matter of fact, the ill-formedness of (49a) is attributed to the violation of the subject condition. Notice that a problem with the PCC arises from the case of (49b). That is, (26b) is far more acceptable than (26a) regardless of the violation of the PCC in both cases. However, under the PSB, (49b) turns out to be well-formed; whom_{i} is scope bound by [+WH]_{i} COMP in the matrix CP, which is defined as its relevant scope by (40) while t_{i} is locally Â-bound by who_{i}, since it is not c-commanded by whom_{i} in A-position in spite of the equation of indices, i = j. Thus, no violation in (49b) arises under the effect of the PSB, as expected.
Let us now consider the case of the examples in (28), where the superiority effects disappear as opposed to the prediction of the PCC. The relevant S-structure of each example is as follows:

\[(50)\]

\[a. [\text{CP} \text{which man} \{\text{[CP} \text{[CP} \{\text{IP you persuade} \text{t} \{\text{[IP PRO to read]\}}\}]\}]\]

\[b. [\text{CP} \text{which book} \{\text{[CP} \text{[CP} \{\text{IP you persuade which man} \{\text{[IP PRO to read}\}]\}]\}]\]

In (50a), no problem with the PSB arises; \textit{which book} is scope-bound and further \textit{t} is locally \textit{A}-bound. Therefore, (50a) is well-formed from the perspective of the PSB and hence (28a) turns out to be acceptable. On the other hand, a serious problem with the PSB follows from the case of (50b). In short, \textit{t} leads to the violation of principle (C) of the binding theory as a consequence of the equation of indices. Nevertheless, (28b) is perfectly acceptable as opposed to the prediction of the PSB in the interaction with the binding theory.

However, a plausible answer to this problem is in order. It is not absurd to assume that the \textit{wh-in-situ} that must be scope-bound and hence be coindexed with \textit{+[WH]} COMP is not the whole \textit{which}-phrase, \textit{which man}, but only the specifier of the phrase, \textit{which}, in the case that the internal structure of \textit{which man} is assumed to be represented as follows: (See May and Gueron (1984) for a similar suggestion.)

\[(51)\]

\[
\begin{array}{c}
\text{NP} \\
\text{(SPEC)} \\
\text{NP} \\
\text{which man}
\end{array}
\]

Note that \textit{man} is assumed to be a lexical governor for \textit{which} in such a structure as (51). Given the assumption concerning the internal structure of \textit{which}-phrase,\(^\text{16}\) \textit{t} in (50b) no longer violates principle (C) of the binding theory.

\(^{16}\) In Pesetsky(1984), the contrast in grammaticality between (12b) and (28b) is assumed to follow from the difference of properties between D-linked \textit{wh-}phrases and non-D-linked \textit{wh-}phrases. In short, \textit{wh-}phrases such as \textit{which man} are included in the category of D-linked \textit{wh-}phrase whereas \textit{wh-}phrases such as \textit{who} are in the category of non-D-linked \textit{wh-}phrase. He
theory, regardless of the equation of indices (such as $i = j$), since \textit{which}_i, just assigned index $i$ instead of \textit{which man}, does not c-command $t_j$ beyond the first maximal projection NP dominating it. Thus, as is expected, (50b) as well as (50a) turns out to be well-formed by the direct or indirect effects of the PSB under some extension of assumption.

4. Conclusion

So far, this paper has touched on the issue of "superiority effects" related to multiple \textit{wh}-constructions in English. As we have examined, it is extensively assumed in the GB framework that the superiority effects concerning multiple \textit{wh}-constructions may be subsumed under one of the conditions such as the ECP, the PCC that the GBT, each of which is required to apply, in its own manner, to the LF representation that is mapped from S-structure by LF movement of \textit{wh}-in-situ for their scope interpretation. However, it comes to light under the arguments of this paper that these conditions on LF fail to account for the whole phenomena of superiority effects concerning multiple \textit{wh}-questions in English. As is argued in Pesetsky(1982) and May(1985), the PCC is estimated to be superior to the ECP and the GBT to the extent that certain 'pure' superiority phenomena appearing in multiple \textit{wh}-questions that cannot be explained either by the ECP or by the GBT fall under the effect of the PCC. On the other hand, it is also demonstrated in this paper that other empirical problems with the PCC arise from various examples examined in the previous section. Furthermore, another conceptual problem results from the LF conditions for superiority effects; they have recourse to only abstract (and hence not real) representation, that is, LF, which is hypothesized for scope interpretation of quantifier in the GB framework.

Therefore, this paper has argued that these LF conditions concerning superiority effects related to multiple \textit{wh}-questions in English should be rejected in favor of the PSB suggested as in (38'-41), which applies to S-structure, rather than to LF, in which the relevant scope for \textit{wh}-in-situ is determined by the coindexation of it with [+WH] COMP. Finally, it is demonstrated in this paper that most of the empirical problems with the LF further assumes that only non-D-linked \textit{wh}-phrases undergo LF movement and hence fall under the PCC. Thus, without reference to the internal structure of \textit{wh}-phrases, (28b) turns out grammatical under the PCC.
approaches may be solved by the PSB in the interaction with principle (C) of the binding theory.

REFERENCES


Cambridge, Massachusetts.

Department of English
Hansung University
392-2 Samsun-Dong, Sungbuk-ku
Seoul 136-042
Korea