RELATIONS IN MINIMALISM

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In this paper, after reviewing two distinct approaches to syntactic relations, Epstein et al.’s (1998) derivational approach and Chomsky’s (2000) compositional approach, I show that, given Epstein, Kitahara, and Seely’s (2010) analysis of structure-building (based on Merge \((X, Y) \Rightarrow \{X, Y\}\)), the main empirical difference between these two approaches disappears. I then discuss Chomsky’s (2007, 2008) suggestion that c-command is eliminable in favor of probe-goal and minimal search conditions. If probe-goal and minimal search conditions are sufficient to characterize not only the empirically desirable aspects of c-command, but also other syntactically significant relations, then any further characterization of such relations appears to be superfluous.*

Keywords: syntactic relations, c-command, probe-goal, minimal search, Merge \((X, Y) \Rightarrow \{X, Y\}\)

1. Introduction

In this paper, I will discuss relations in minimalism, in particular, how syntactically significant relations such as c-command become available under a minimalist perspective. First, I briefly discuss the strong minimalist thesis (section 2) and review two distinct approaches to syntactic relations: Epstein

* Part of the material in this paper was presented at the ELSJ 3rd International Spring Forum 2010 (held at Aoyama Gakuin University on April 25, 2010). I am grateful to the participants for clarifying remarks. Also, I would like to thank Jun Abe, Noam Chomsky, Ruriko Kawashima, Hirohisa Kiguchi, Roger Martin, Miki Obata, Masayuki Oishi, Mamoru Saito, Chris Tancredi, Shigeo Tonoike, and especially Samuel D. Epstein and T. Daniel Seely for insightful comments and helpful discussion. For valuable feedback, I am grateful to two anonymous EL reviewers. All remaining errors are, of course, my own. Special gratitude goes to the following two institutions where this research was conducted: the Institute of Cultural and Linguistic Studies at Keio University and the Department of Linguistics at the University of Michigan, Ann Arbor. The research reported here was supported in part by the Ministry of Education, Culture, Sports, Science and Technology (Grant-in-Aid for Scientific Research (C) #22520409).

English Linguistics 28: 1 (2011) 1–22 —1—
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et al.’s (1998) derivational approach (section 3) and Chomsky’s (2000) compositional approach (section 4). I then review in detail Epstein, Kitahara and Seely’s (2010) analysis of structure-building, based on the simplest form of merger and its “counter-cyclic” application (section 5), which eliminates the main empirical difference between Epstein et al. and Chomsky’s approaches. With this result, I would like to discuss Chomsky’s (2007, 2008) suggestion that c-command is eliminable in favor of probe-goal and minimal search conditions (section 6). I then discuss two more cases (sections 7 and 8), in which probe-goal and minimal search conditions play an important role.

2. From the First Factor to the Third Factor

In this section, I review the three factors in language design (noted in Chomsky (1965), and restated in Chomsky (2005)), and from that perspective, I attempt to clarify the strong minimalist thesis (presented in Chomsky (1993), and elaborated in Chomsky (2000)).

Chomsky (1965) attributes the acquisition of language to (at least) the following three factors:

… there is surely no reason today for taking seriously a position that attributes a complex human achievement [acquisition of language, HK] entirely to months (or at most years) of experience, rather than to millions of years of evolution or to principles of neural organization that may be even more deeply grounded in physical law …

(Chomsky (1965: 59))

In more familiar terms, “months (or at most years) of experience” refers to individual experience (or primary linguistic data); “millions of years of evolution” to genetic endowment (or the initial state of the faculty of language); and “principles of neural organization that may be even more deeply grounded in physical law” to principles not specific to the faculty of language (FL).

Almost 40 years later, at the annual meeting of the Linguistic Society of America (January 9, 2004), Chomsky essentially restated these three factors as the three factors in language design:

The biolinguistic perspective regards the language faculty as an “organ of the body,” along with other cognitive systems. Adopting it, we expect to find three factors that interact to determine (I-) languages attained: genetic endowment (the topic of Universal Grammar), experience, and principles that are language- or even organism-
The first factor is genetic endowment, the second factor is experience, and
the third factor is language-independent principles.

Since the early 90’s, there has been a conceptual shift of focus in the
study of FL from the first factor (the genetic endowment) to the third factor
(language-independent principles). In recent work, Chomsky highlights this
shift with the following two opposing questions:

Throughout the modern history of generative grammar, the problem
of determining the character of FL has been approached “from top
down”: How much must be attributed to UG to account for language
acquisition? The MP [Minimalist Program, HK] seeks to approach
the problem “from bottom up”: How little can be attributed to UG
while still accounting for the variety of I-languages attained, relying
on third factor principles? (Chomsky (2007: 4))

Assuming that FL is expected to satisfy the interface conditions imposed by
virtue of its place within the array of cognitive systems, the “bottom up”
approach asks how close the third factor principles come to providing an
optimal solution to the interface conditions. To the extent that an optimal
solution obtains, FL is something like a “perfect system,” meeting the inter-
face conditions in a way satisfying third factor principles. The strong mini-
amalist thesis takes FL to be a “perfect solution” to the interface conditions
in this sense.

With this interpretation of the strong minimalist thesis, I would like to
ask how syntactically significant relations such as c-command become avail-
able under the severe restrictions imposed by the third factor principles. In
the following two sections, I briefly review two distinct approaches to syn-
tactic relations: Epstein et al.’s (1998) derivational approach and Chomsky’s

3. A Derivational Approach to Syntactic Relations

Epstein et al. (1998) advance the thesis that the derivational process ex-
presses all syntactically significant relations (see also Epstein (1999), Epstein
and Seely (2002, 2006)). For example, as opposed to Reinhart’s (1979)
representational definition of c-command, Epstein et al. (1998) propose the
following derivational definition of c-command (where the notion “contain”
is taken to be reflexive):

\[ (1) \quad \alpha \text{ c-commands } \beta \text{ if } \alpha \text{ is merged with } K \text{ containing } \beta. \]

The empirical content of the representational definition of c-command is
deduced from an independently motivated “partial ordering” of Merge operations, entailed by Chomsky’s (1993) extension condition. However, Chomsky (2000: 146, fn. 67) questions the role of containment in (1), i.e., why does α merged with K c-command β contained by K? He also asks why α merged with K containing β (where K ≠ β) asymmetrically c-commands β. Epstein et al. (1998) address these issues, taking containment and asymmetry of c-command to be a natural consequence of the inevitable “must follow” relation of Merge operations in a derivation, as imposed by the extension condition.

4. A Compositional Approach to Syntactic Relations

Chomsky (2000) proposes an alternative approach to syntactic relations. He first assumes that Merge directly provides two relations, sisterhood and immediate contain:

Merge takes two objects α and β and forms a new object K(α, β). The operation provides two relations directly: sisterhood, which holds of (α, β), and immediate contain, which holds of (K, α), (K, β), and (K, K) (taking it to be reflexive). (Chomsky (2000: 116))

This is a straightforward derivational approach, but given these relations, Chomsky (2000) suggests that the elementary operation of composition of relations (hereafter, composition of relations) applies to the output of Merge, and as a result, three more relations—the transitive closure contain of immediately contain, identity, and c-command—become available:

Suppose we permit ourselves the elementary operation of composition of relations.

Applying it in all possible ways, we derive three new relations: the transitive closure contain of immediately contain, identity (= sister(sister)), and c-command (= sister(contain)).

(Chomsky (2000: 116))

Under this compositional approach, therefore, contain and c-command can be defined as follows: (i) K contains α iff K immediately contains α or immediately contains L that contains α, and (ii) α c-commands β iff α is the sister of K that contains β. Given these definitions (along with the general assumptions adopted in Chomsky (2000)), the asymmetry of c-command naturally follows: if α is the sister of K that contains β (where K ≠ β), then α c-commands β, but β, a category inside K, does not c-command α.

It has been pointed out that there is an empirical difference between Epstein et al.’s (1998) derivational approach and Chomsky’s (2000) com-
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5. "Counter-Cyclic" Merge and Intersecting Set-Theoretic Objects

Merge is defined as “an operation that takes \( n \) syntactic objects (SOs) already formed, and constructs from them a new SO” (Chomsky (2008: 137)), and it is assumed that “restriction of computational resources limits \( n \) for Merge to two” (Chomsky (2008: 138)). The binary limitation \( n=2 \) is thus taken to be a property of Merge deducible from a general principle of efficient computation. Another principle of efficient computation is the no-tampering condition (NTC): “Merge of X and Y leaves the two SOs unchanged” (Chomsky (2008: 138)). Given NTC, Merge does not alter X or Y; rather, it places the two SOs in a set. The inclusiveness condition is another natural principle of efficient computation: “no new objects are added in the course of computation apart from rearrangements of lexical properties” (Chomsky (1995: 228)). Given the inclusiveness condition, Merge does not add bar levels, indices, or any similar non-explanatory

positional approach (see Kawahima and Kitahara (1996) and Epstein et al. (1998)). To see this, let’s consider a concrete case involving “counter-cyclic” subject-raising. After \( \{C, \{T, vP\}\} \) is constructed, Subject (a member of \( vP \)) is merged internally with \( \{T, vP\} \) (a member of \( \{C, \{T, vP\}\} \)). In Chomsky (2007, 2008), it is assumed that this “counter-cyclic” application of Merge (raising Subject to Spec-T after the merger of C and TP) applies in just this manner and forms \( \{C, \{Subject, \{T, vP\}\}\} \) by replacing \( \{T, vP\} \) in \( \{C, \{T, vP\}\} \) with \( \{Subject, \{T, vP\}\} \). Given this new set-theoretic syntactic object (SO), namely \( \{C, \{Subject, \{T, vP\}\}\} \), Chomsky’s (2000) compositional approach would yield a c-command relation between C and Subject (occupying Spec-T), regardless of when Subject was raised to Spec-T; but, as noted by Kawahima and Kitahara (1996), Epstein et al.’s (1998) derivational approach would not yield a c-command relation between C and Subject (occupying Spec-T) if Subject was raised to Spec-T “counter-cyclically,” because C was merged with spec-less TP (prior to subject-raising), and the c-command domain of C was determined at the derivational point of merger of C and speeless TP.

This empirical difference, however, disappears if we adopt Epstein, Kitahara, and Seely’s (2010) analysis of structure-building, which (in effect) entails that all established syntactic relations (among existing categories) remain unaltered throughout a derivation. In the following section, I review the details of their analysis of structure-building and examine how this entailment holds.
devices throughout a derivation. Thus, the simplest form of merger operation is Merge (X, Y) => {X, Y} that takes two SOs, X and Y (keeping to the binary limitation n=2) and forms a new SO={X, Y}, leaving X and Y unchanged (satisfying NTC) and adding no new objects apart from rearrangements of X and Y (satisfying the inclusiveness condition). Epstein, Kitahara, and Seely (2010) (hereafter, EKS) assume that Merge (X, Y) => {X, Y} is the sole structure-building operation of the narrow syntax (NS).

Consider a simple sentence such as *Bill ate rice*. At some point of the derivation, the application of External Merge (EM) takes the phase-head C and merges it with TP, yielding the following SO:

\[(2) \{C, \{T, \{Bill, \{v, \{ate, rice\}\}\}\}\}\]

At this CP phase level in (2), C transmits unvalued phi to T. T, then, functioning as a phi-probe, locates the goal *Bill* (bearing phi and unvalued Case), and Agree (T, *Bill*) takes place, valuing phi on T and Case on *Bill* (see EKS (to appear) for an overview of the mechanics of the derivation). As these features get valued, *Bill* is raised to Spec-T (a residue of EPP), yielding the following SO:

\[(3) \{C, \{Bill, \{T, \{Bill, \{v, \{ate, rice\}\}\}\}\}\}\]

This “counter-cyclic” application of Internal Merge (IM) (raising Subject to Spec-T after the merger of C and TP) is, by hypothesis, an instance of Merge (X, Y) => {X, Y}. But, as noted in section 4, a form of replacement is required to map (2) to (3). In set-theoretic terms, IM of *Bill* to the existing (specless) T 1 (= {T, {Bill, {v, {ate, rice}\}}}) yields a new (specful) syntactic object T 2 (= {Bill, {T, {Bill, {v, {ate, rice}\}}}}). But then T 2 (with *Bill* as Spec-T) replaces T 1 in {C, T 1}, removing T 1 from {C, T 1} and merging T 2 with C. Such replacement yields a new CP (= {C, T 2}). It is this “new” CP (= {C, T 2}), and not the “old” CP (= {C, T 1}), that enters into further derivational processes.

In an earlier framework, Chomsky (1995) notes this additional complexity of “counter-cyclic” IM (or covert movement):

The computational system C_{HL} is based on two operations, Merge and Move. We have assumed further that Merge always applies in the simplest possible form: at the root. What about Move? The simplest case again is application at the root: if the derivation has reached the stage \(\Sigma\), then Move selects \(\alpha\) and targets \(\Sigma\), forming \(\{\gamma, \{\alpha, \Sigma\}\}\). But covert movement typically embeds \(\alpha\) and therefore takes a more complex form: given \(\Sigma\), select K within \(\Sigma\) and raise \(\alpha\) to target K, forming \(\{\gamma, \{\alpha, K\}\}\), which substitutes for K in \(\Sigma\).

(Chomsky (1995: 254))
EKS argue that (i) given the strong minimalist thesis, NS is expected to contain only the simplest structure-building operation, namely Merge \((X, Y) \Rightarrow \{X, Y\}\), but (ii) Merge formulated as such cannot replace existing categories, thus, (iii) NS equipped only with Merge \((X, Y) \Rightarrow \{X, Y\}\) (as the sole structure-building operation) cannot map \((2) (= \{C, T^1\})\) to \((3) (= \{C, T^2\})\) in the way illustrated above (see also Freidin (1999) for the complexities of replacement in an earlier framework).

Returning to the main track, assuming NS to be equipped only with Merge \((X, Y) \Rightarrow \{X, Y\}\), a question arises. What does “counter-cyclic” IM, if permitted, create? Take “counter-cyclic” subject-raising again. EKS suggest that such “counter-cyclic” (Internal) Merge cannot induce replacement but rather necessarily results in a “two-peaked” situation, illustrated by the following informal graph-theoretic representation (where indices are introduced only for expository purposes, and linear order is irrelevant):

\[
\begin{array}{c}
T^2 \\
CP \\
Bill \\
C \\
T^1 \\
T \\
\nu P \\
Bill ...
\end{array}
\]

In set-theoretic terms, the “counter-cyclic” application of IM (merging \(Bill\) to \(T^1\)) results in two distinct but intersecting set-theoretic SOs, which happen to have \(T^1 (= \{T, \nu P\})\) as their “shared” element. That is, as a result of this “counter-cyclic” IM (of \(Bill\) to \(T^1\)), the “workspace” of NS contains two intersecting set-theoretic SOs:

\[
(5) \quad T^2 = \{Bill, T^1\} \text{ and } CP = \{C, T^1\}
\]

EKS argue that, under the law of semantic composition, these two intersecting set-theoretic SOs, each functioning as a root, would not yield a single semantic value if they were sent to the semantic component together. Thus, there must be a way to overcome this “two-peaked” or set-theoretically intersecting situation in the “workspace” of NS. One possible way out of this situation, outlined by EKS, is to send the two intersecting SOs to the semantic component separately. Specifically, EKS propose that Transfer dissolves this intersecting situation by removing one intersecting set from the “workspace” of NS (cf. Chomsky (2004)). In effect, one “peak” (i.e. one of the two intersecting sets) must be sent to the semantic compo-
nent by Transfer at this point of the derivation. Given this analysis, cyclic Transfer of TP at CP is deduced (given that the phase-edge must be left for the derivation to continue). Furthermore, if vP, in addition to CP, is a phase (as argued by Chomsky (2000)), then cyclic Transfer of VP at vP also follows. See EKS (2010) for more detailed discussion of positive empirical consequences (e.g. Icelandic object agreement).

Summarizing, the “counter-cyclic” application of IM (raising Subject to Spec-T after the merger of C and TP) cannot map \{C, \{T, vP\}\} to \{C, \{Subject, \{T, vP\}\}\}. Instead, it necessarily forms \{Subject, \{T, vP\}\}, which intersects with \{C, \{T, vP\}\}. This “two-peaked” or intersecting situation arises as an inevitable consequence of NS equipped only with Merge \((X, Y) \Rightarrow \{X, Y\}\). In effect, NS can create (but not destroy) relations by applying Merge \((X, Y) \Rightarrow \{X, Y\}\). Thus, it naturally guarantees that all established syntactic relations (among existing categories) remain unaltered throughout a derivation.

As an immediate consequence of their structure-building analysis (discussed above), EKS (2010) demonstrate that the invisibility of Spec-T to C (noted but not fully analyzed in Chomsky (2007, 2008)) is deducible. First recall Chomsky’s (2008) analysis of the ban on the extraction of a PP complement out of a phrase in Spec-T. Consider (6) (an English example drawn from Chomsky (2008)):

\[(6) *_{\text{CP}} \text{[PP of which car] did }_{\text{TP}} \text{[the driver tPP] cause a scandal}]?\]

The deviance of (6) follows in part from the stipulation that Spec-T is invisible (as a goal) to (the probe) C. Chomsky (2008) proposes that Spec-T becomes invisible to further computation once its Case is valued, generalizing Chomsky’s (2000, 2001) inactivity condition (see Nevins (2005), Obata and Epstein (2008) for arguments against the inactivity condition).

Given this set of assumptions, the invisible status of the surface subject position (Spec-T) follows, but what about the status of the vP-internal subject position (Spec-v)? Chomsky (2008: 147–148) assumes that there is a cost to extracting a PP complement out of a phrase in Spec-v, but he (2008: 160, fn. 39) notes that choice of v might have an effect, since sentences such as of which books did the author receive the prize is (perhaps) more acceptable than (6). In what follows, I demonstrate that the invisibility of Spec-T is deducible, while leaving aside the issue concerning the status of Spec-v.

EKS (2010) note that there are at least two problems concerning Chomsky’s analysis of the invisibility of Spec-T. First notice that Spec-C (unlike Spec-T) must continue to be visible after the valuation of its Case,
in order to allow successive cyclic wh-movement (e.g., *who do you think saw her?). Exempting the construction of A'-chains from such a generalized inactivity condition is a stipulation, given that this implicit asymmetry between A- and A'-chains remains to be explained. The alleged invisibility of Spec-T poses another problem. Take an indirect question, *I wonder who saw her.* Under Chomsky’s (2008) phase-based model, Spec-C and Spec-T (each occupied by *who*) must be created simultaneously at the embedded CP phase level, and Spec-T becomes invisible upon the valuation of its Case. But then, how can Spec-T, being invisible, count as a position lower than Spec-C? Note that the phonological component must know the relative height of Spec-T to determine whether it should be pronounced or not. Thus, two questions arise: How does Spec-T become invisible, while Spec-C continues to be visible? And how can the relative height of Spec-T be calculated when Spec-T itself is invisible?

EKS (2010) provide a principled answer to each of these questions. First recall that, under Epstein et al.’s (1998) derivational approach, NS establishes syntactic relations derivationally through the application of Merge, and no syntactic relation can be arbitrarily defined on output representations (contra most earlier frameworks, e.g. Chomsky (1981)). Specifically, c-command is the relation that Merge establishes between α and terms of β at the exact point of merging α with β. As mentioned above, under this approach, if α is merged “counter-cyclically” with an embedded category γ, where γ is not the root but is a distinct term of β (i.e., γ is embedded within β), then representationally, all the terms of β that appear above γ would either c-command or dominate α, but derivationally, these higher terms of β will neither c-command nor dominate α. Why? Because when these higher terms of β underwent their birth-merger, they were not merged with a category containing α now residing in the “counter-cyclically” merged position. Thus, these higher terms of β bear no derivational relation to such a “counter-cyclically” merged α.

If NS is equipped only with Merge (X, Y) => {X, Y}, however, it naturally follows that neither C nor Spec-C c-commands a “counter-cyclically” created Spec-T even under Chomsky’s (2000) compositional approach. That is, as shown in the “two-peaked” graph-theoretic representation (4), C does not c-command the “counter-cyclically” created Spec-T derivationally or representationally.

To see this point, let’s examine the indirect wh-question, *I wonder who saw her.* Consider the following graph-theoretic representation of the embedded CP (where indices are introduced only for expository purposes, and
In (7), neither who3 (= Spec-C) nor C c-commands who2 (= Spec-T). Why? Within the feature-inheritance analysis developed by Richards (2007) and Chomsky (2007, 2008), EM merging C with T1 precedes the necessarily simultaneous applications of IM, which create Spec-T and Spec-C by merging who with T1 (forming T2) and who with C1 (forming C2), respectively. With this simultaneous application of merger operations, it naturally follows that who2 (= Spec-T) c-commands every term of its merged sister T1, but neither C nor who3 (= Spec-C) c-commands who2 (= Spec-T), as represented in (7). This is the case because (i) C was merged with T1 (of which Spec-T was not at the time a term), (ii) who3 (= Spec-C) was merged with C1 (of which Spec-T was not at the time a term), and (iii) NS is equipped only with Merge (X, Y) \Rightarrow \{X, Y\}; hence, all established syntactic relations (among existing categories), including the two sisterhood relations (C, T1) and (who3, C1), are preserved.

Under EKS’s (2010) analysis, therefore, the invisible status of Spec-T to both C and Spec-C can be deduced as a property of NS equipped only with Merge (X, Y) \Rightarrow \{X, Y\}. Also note that the stipulated link between invisibility and inactivity can be dispensed with; hence, Spec-C continues to be visible to any “higher” category merged with a category that contains Spec-C, and it is allowed to undergo successive cyclic wh-movement, as desired.

As for calculating the height of invisible Spec-T, if the deduction of the invisible status of Spec-T (discussed above) is on the right track, then the height of Spec-T is not calculated by the position of Spec-T itself. Rather, EKS argue, the height of Spec-T should be calculated by the position of its occurrence.

Chomsky (1995) defines an occurrence of K as the category to which K
is merged. An occurrence of Spec-T is then its merged sister $T^1$. Under this occurrence-based calculation, the position of a category is uniquely determinable by reference to its merged sister. Thus, Spec-T counts as a position lower than Spec-C, because $T^1$ (= the occurrence of Spec-T) is a distinct category contained by $C^1$ (= the occurrence of Spec-C), and this containment relation between $T^1$ and $C^1$ is established derivationally.

This brings us to one of the central points of this paper, the elimination of the main empirical difference between Epstein et al.’s (1998) derivational approach and Chomsky’s (2000) compositional approach. That is, given that NS is equipped only with Merge $(X, Y) \Rightarrow \{X, Y\}$, both the derivational approach and the compositional approach make the following prediction: if $C$ is merged with $\{T, vP\}$ prior to subject-raising, $C$ will never be able to c-command Spec-T, even if Subject (a member of $vP$) is later merged with $\{T, vP\}$, becoming Spec-T. Why? Because “counter-cyclic” IM (raising Subject to Spec-T after the merger of C and TP) creates $\{Subject, \{T, vP\}\}$, which intersects with $\{C, \{T, vP\}\}$; it does not create $\{C, \{Subj, \{T, vP\}\}\}$ via replacement.

6. Eliminating C-Command in favor of Probe-Goal and Minimal Search Conditions

Given that there now appears to be no major empirical difference distinguishing Epstein et al.’s (1998) derivational approach from Chomsky’s (2000) compositional approach, it becomes more difficult to determine which is the correct approach. The derivational approach argues that derivation, which must be assumed in any case, is sufficient to provide all syntactically significant relations, and the compositional approach argues that Merge and the elementary operation of composition of relations are the minimal assumptions, under which all syntactically significant relations are made available.

In recent work, however, Chomsky sheds new light on this issue from a third factor perspective. He (2007, 2008: 141) suggests that “[w]hether c-command plays a role within the computation to the C-I interface is an open question.” For example, taking the issue of binding theory, he argues that c-command is not required, but rather that set-membership and probe-goal suffice.

Chomsky (2008: 141–142) presents Reuland’s (2005) discovery as an important case and argues that binding relations should be reformulated as probe-goal relations. Consider (8) (a Norwegian example drawn from Reu-
land (2005)):

(8) Det ble introdusert en mann for selv / *ham selv

It became introduced a man to himself

Data such as (8) are analyzed by Reuland (2005) as structures of the form [... T... XP... R ...], where “the antecedent [XP] does not c-command the reflexive [R] but both are c-commanded by the head [T] that agrees with the antecedent [XP]” (Chomsky (2007: 18)). Note this is the case of probe-goal by the head [T], not c-command by the antecedent [XP]. Within this analysis, it is possible to reformulate Binding Condition A as a condition requiring the reflexive [R] to be in the search domain of the head [T] that agrees with the antecedent [XP]. Suppose that such a reformulation of Binding Condition A is tenable. Then the notion c-command, whether derivational or compositional, appears to play no role in the analysis of (8). Note that if the c-commanding pronoun X is taken to be the label of \{X, SO\}, then Binding Condition C may be reformulated as a probe-goal relation as well (Chomsky (2008: 141)). Similarly, if there is a negative head whose search domain contains a negative polarity item NPI, then the licensing of NPI may also follow under this probe-goal analysis. It is probe-goal (not c-command) that counts as a syntactically significant relation. But a question still remains. If not c-command, what guarantees the very restrictive relation between the probe and the goal?

Chomsky (2007: 9) answers “[r]estricted to heads (probes), c-command reduces to minimal search,” and “[m]inimal search conditions limit the goal of the probe to its complement, the smallest searchable domain.” Take K = \{H, XP\}. Suppose NS accesses K. What does NS find in K? NS immediately finds a lexical item H (a bundle of features, provided by the lexicon) and a two-membered set XP (a set-theoretic SO, constructed by Merge). The former, being a lexical item, makes available what matters to NS, while the latter, being a set, does not. Thus, with minimal search, NS identifies H as the probe. What’s next? Suppose minimal search continues and seeks a matching goal for the probe H. What will be a natural searchable domain of the probe H? Given that K is a two-membered set (a consequence of Merge (X, Y) => \{X, Y\}), a natural option will be XP, or informally speaking, the set sitting next to the probe H. In effect, if one becomes a probe, then the other becomes a domain for the probe to search. Thus, the natural searchable domain of the probe H will be XP, the only remaining member of K, distinct from H, what we have been calling the complement of the head H. But in what sense does this natural searchable domain of the probe H count as the smallest searchable domain? A
null hypothesis is that this natural searchable domain of the probe $H$ is always available to the probe $H$, because $K$ is necessarily a two-member set. So, even if a set later merged to $K$—what we have been calling the specifier of $K$—is searchable by the probe $H$, this set (later merged to $K$) will always count as an additional domain to the natural searchable domain of $H$. Thus, it follows that the natural searchable domain $XP$—the complement of the head $H$—is always the smallest searchable domain of the probe $H$, where minimal search seeks a matching goal for the probe $H$.

Under these assumptions, c-command can be eliminated from the computation to the C-I interface in favor of probe-goal and minimal search conditions. If probe-goal and minimal search conditions are sufficient to characterize the empirically desirable aspects of c-command, then any further characterization of that notion would appear to be superfluous. Recall that c-command, whether derivational or compositional, appears to play no significant role in the analysis of (8). Under the current assumptions, it is probe-goal (not c-command) that counts as a syntactically significant relation. If the elimination of c-command in favor of probe-goal and minimal search conditions is tenable, it is very surprising, hence intriguing.

Needless to say, to attain a better understanding of this very restrictive approach to syntactic relations, we must identify and investigate the properties of third factor principles, in particular, probe-goal and minimal search conditions. In the following two sections, I would like to discuss two more cases in which probe-goal and minimal search conditions play an important role.

7. Revisiting the Labeling Algorithm and the Feature-Inheritance Analysis

In this section, I discuss two distinct applications of EM: EM of external argument DP to $vP$ and EM of internal argument DP to $VP$. These two applications of EM pose a problem for Chomsky’s (2008) labeling algorithm; and, in addition, the latter application poses a problem for the Case-theoretic analysis of feature-inheritance, developed by Richards (2007) and Chomsky (2007, 2008). After presenting these two problems, I propose a unified solution to them and discuss some of its consequences.

Chomsky (2008: 145) argues that “the label of SO must be identifiable with minimal search, by some simple algorithm” and suggests the following labeling algorithm (where LI is a lexical item):
(9) a. In \{H, α\}, H an LI, H is the label.
    b. If α is internally merged to β, forming \{α, β\}, then the label of β is the label of \{α, β\}.

This two-part algorithm, motivated on independent empirical grounds (see Donati (2006)), makes (at least) the following three predictions: (i) if EM merges H and XP, forming \{H, XP\}, then H will be the label of its outcome \{H, XP\}; (ii) if IM merges XP and YP, forming \{XP, YP\}, then the probe (finding a goal for IM) will be the label of its outcome \{XP, YP\}; and (iii) if EM merges XP and YP, forming \{XP, YP\}, then the label of its outcome \{XP, YP\} will not be determined. The last case, yielding a “no label” situation, is regarded as a problem. Consider the derivation of the boy read the book, which involves EM of the boy to vP, yielding the following SO:

\[
(10) \quad \{\{\text{the, boy}\}, \{v, \{\text{read, \{the, book}\}}\}\}
\]

The SO in (10) is the type of \{XP, YP\} formed by EM; hence, it has no label of its own. One potential problem for this “no label” situation is that if NS cannot access the label of the SO in (10), it won’t be able to access the edge-feature that permits the SO in (10) to undergo Merge.

The same problem arises in the course of a derivation with a three-place predicate. Consider the derivation of the boy put the book on the table, which involves EM of the book to VP, yielding the following SO:

\[
(11) \quad \{\{\text{the, book}\}, \{\text{put, \{on, \{the, table\}}\}\}\}
\]

The SO in (11) is the type of \{XP, YP\} formed by EM; hence it has no label of its own. So, given the VP-shell analysis, proposed by Larson (1988) and later modified by Chomsky (1995), the problematic “no label” situation arises in ditransitive structures like (11), even prior to EM of the external argument DP to vP. Furthermore, the SO in (11) poses a problem for the Case-theoretic analysis of feature-inheritance, developed by Richards (2007) and Chomsky (2007, 2008). That is, at the vP phase level, the phi-probe on put (inherited from v) won’t be able to find the book as its goal, because the book is outside the search domain of put. Thus, NS won’t be able to value Case on the book.

For the sake of discussion, let us assume that NS has managed to construct (12) and examine the Case-theoretic problem noted above:

\[
(12) \quad \{\{\text{the, boy}\}, \{v, \{\{\text{the, book}\}, \{\text{put, \{on, \{the, table\}}\}\}\}\}\}
\]

Under the Case-theoretic analysis of feature-inheritance, T and V inherit unvalued phi from C and v, respectively. These heads (inheriting unvalued phi) are responsible for the valuation of Case, and they value Case in accord with the probe-goal theory of agreement, which limits “the goal of the probe to its complement, the smallest searchable domain” (Chomsky (2007:...
Given this much, the problem posed by (12) becomes obvious. That is, at the vP phase level in (12), put (inheriting unvalued phi from v) is responsible for the valuation of Case on the book. However, the book, occupying the specifier of put, is not in the search domain of put. Notice that the set containing put as a member is \{put, \{on, \{the, table\}\}\}, and the book is not contained in the smallest searchable domain of put, namely, put's complement (\{on, \{the, table\}\}). Thus, neither the Case of the book nor the phi of put will get valued. In short, EM of the internal argument DP to VP not only forms a “label-less” SO but also places the internal argument DP outside the search domain of V, causing the derivation to crash if that argument's Case remains unvalued.

Accepting the two problems noted above, I would now like to outline a unified solution to them. First, recall that if put stays in situ, excluding the book from its search domain, then NS cannot value Case on the book or phi on put. Thus, one (and arguably the only) logical possibility is that put undergoes IM, expanding its search domain. This is essentially the idea of expanding the minimal domain by V-movement in Chomsky (1995). Pursuing this possibility, I propose the “last resort” implementation of IM of label L to label-less K, formulated as (13):

(13) If K is a SO bearing no label, then IM takes a label L that was accessed to form K, and merges L to K, forming a new SO = \{L, K\}.

By hypothesis, (13) takes place only when EM forms a label-less SO. Note that (13) may be regarded as an operation breaking a “symmetric” relation between the two members of this label-less SO (arguably, an instance of the “symmetry-breaking” operation in the sense of Moro (2000)).

With this proposal, let us return to the derivation in question. Once again, consider EM of the book to VP and its outcome in (11) (= \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}). The SO in (11) has no label of its own; hence, in accord with (13), IM merges put (a label that was accessed to form the SO in (11)) to this label-less SO itself, forming the following SO (where the search domain of put is, in effect, expanded):

(14) \{put, \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}\}

The SO in (14) has a label of its own, identifiable with minimal search, namely put. Thus, the “no label” situation is resolved.

As the derivation continues, EM of v to the SO in (14) forms the following SO:

(15) \{v, \{put, \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}\}\}

Subsequently, EM of the boy to the SO in (15) forms the following SO:
(16)  \{\{the, boy\}, \{v, \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}\}\}\}

At this \(v_P\) phase level in (16), \(the\) \(book\) is in the search domain of (raised) \(put\), and NS can (in principle) value the Case on \(the\) \(book\) and the phi on (raised) \(put\) (after (raised) \(put\) inherits phi from \(v\)). Thus, the problem for the Case-theoretic analysis of feature-inheritance is also resolved.

The SO in (16) exhibits the problem posed by EM of external argument DP to \(v_P\). But this problem is resolved in exactly the same way as the one posed by EM of internal argument DP to VP. The SO in (16) has no label of its own; hence, in accord with (13), IM merges \(v\) (a label that was accessed to form the SO in (16)) to this label-less SO itself, forming the following SO:

(17)  \{\{v, \{\{the, boy\}, \{v, \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}\}\}\}\}

The SO in (17) has a label of its own, identifiable with minimal search, namely \(v\).

As shown above, the last resort operation (13) resolves not only the problem confronting the Case-theoretic analysis of feature-inheritance, but also the “no label” situation, induced by the two applications of EM: EM of external argument DP to \(v_P\) and EM of internal argument DP to VP.

Assuming that this unified solution is on the right track, I would like to point out two immediate consequences of the proposed analysis. One concerns theta-theoretic “assigner-assignee” relations, and the other concerns notions such as “Spec” and “Complement.”

Notice that, under the current assumptions, by applying the last resort operation (13), all theta-theoretic “assigner-assignee” relations can be reduced to probe-goal relations. To be concrete, let’s add the relevant theta roles to (17), as in (18):

(18)  \{\{v, \{\{the, boy\}, \{v, \{\{the, book\}, \{put, \{on, \{the, table\}\}\}\}\}\}\}\}

\(v\) assigns AGENT to \(the\) \(boy\) in the search domain of (raised) \(v\), (ii) \(put\) assigns THEME to \(the\) \(book\) in the search domain of (raised) \(put\), and (iii) \(put\) assigns LOCATION to \(on\) \(the\) \(table\) in the search domain of (in-situ) \(put\). So, theta-theoretic “assigner-assignee” relations, including those involving an external argument (a residue of m-command), can be reduced to probe-goal relations, though how we interpret “theta-assignment” itself is an open question.

Also notice that, given the last resort operation (13), EM and IM yield
different results concerning the status of “Spec.” Suppose α and β are not lexical items, and L is the label of β. Then, if α is internally merged to β (forming \{α, β\}, whose label is L under (9b)), IM of L to \{α, β\} under (13) will not take place, and α will be excluded from the search domain of L, meaning that α is a “Spec” of L. In contrast, if α is externally merged to β (forming \{α, β\}, which has no label of its own), IM of L to \{α, β\} under (13) will take place, and α will be included in the search domain of (raised) L, meaning that α is part of the “Complement” of (raised) L (see Epstein (1998) for exposition of a similar idea in an earlier framework). Thus, informally speaking, only IM can create a genuine “Spec” of L that is excluded from the “Complement” of L. This distinction between EM and IM, made available under (13), may correlate nicely with the duality of semantics: “EM yields generalized argument structure (theta-roles, the ‘cartographic’ hierarchies, and similar properties); and IM yields discourse-related properties such as old information and specificity, along with scopal effects” (Chomsky (2008: 140)).

8. Eliminating the Superiority Condition and the Tucking-in Operation

In this section, after reviewing Richards’s (1997, 1999) analysis of superiority phenomena in Bulgarian, I first argue that, under Chomsky’s (2007, 2008) probe-goal theory of agreement, the superiority condition (formulated in Chomsky (1973)) is no longer available. I then argue that neither the superiority condition nor the tucking-in operation (formulated in Richards (1997, 1999)) is required to explain core superiority phenomena in Bulgarian.

Adopting the superiority condition (given two wh-words in the same cycle, the higher wh-word must move first, see Chomsky (1973)), Richards (1997, 1999: 135) examines Bulgarian data such as (19a, b) (drawn from Rudin (1988: 472–473)):

(19) a. koj kogo vižda
   Who whom sees
   ‘who sees whom’

b. *kogo koj vižda
   whom who sees

Bulgarian is a multiple overt wh-movement language, so both koj ‘who’ and kogo ‘whom’ undergo overt wh-movement, but which one moves first?

Richards (1997, 1999: 135) notes the following two possibilities: (i) “if we wish to maintain the idea that movement always expands the tree,
creating a specifier higher than all the existing structure, we must apparently conclude here that the lower of the two wh-words (kogo ‘whom’ in (19a)) must move first,” and (ii) “another possibility, of course, would be to say that the order of wh-movements in this case is just as in English: koj ‘who’ moves first, followed by movement of kogo ‘whom’ to a lower specifier.” Richards pursues the latter possibility, where the lower wh-word kogo ‘whom’ undergoes the tucking-in operation to a lower specifier of C than that occupied by koj ‘who,’ which has moved first.

However, I argue that, under Chomsky’s (2007, 2008) probe-goal theory of agreement, (i) the superiority condition is no longer available, but (ii) neither the superiority condition nor the tucking-in operation is required to capture the order of wh-words exhibited by Bulgarian (19a, b).

Chomsky (2007, 2008) eliminates the unvalued features postulated to implement wh-movement (e.g. [uQ], [uWh], see Chomsky (2000)), and defines an A’-position as one that is formed solely by an edge-feature EF of a phase head PH, while other derived positions are A-positions. Under this proposal, A- and A’-positions are distinguished by the manner in which they are derived. That is, A-movement (forming an A-position) is IM contingent on probe by unvalued phi, and A’-movement (forming an A’-position) is IM driven solely by the EF of PH. It is important to note that A’-movement involves no feature-valuation (contra Chomsky (2000)). On this revision, Chomsky (2008: 151) notes that “[w]e need not postulate an uninterpretable feature that induces movement, and can thus overcome a long-standing problem about crash at the lower phase levels in successive-cyclic movement.”

Now suppose (i) there is no unvalued feature inducing wh-movement, and (ii) the EF of PH is indiscriminate. Then, (iii) the EF of C or v can (in principle) seek any goal in its search domain. Adopting this argument, Chomsky (2008: 152) concludes that “there should be no superiority effect for multiple wh-phrases; any can be targeted for movement.” In other words, under this framework, the superiority condition is no longer available.

Chomsky’s (2007, 2008) analysis thus leaves the problem of explaining superiority phenomena in the languages that exhibit them, e.g. English and Bulgarian. Regarding the English data, however, Chomsky and others hold a very skeptical view (see Chomsky (2008: 161, fn. 52) and the references cited there), and suggest that there may be no clear superiority cases in English. As for Bulgarian data, for the sake of discussion, I assume with Richards (1997, 1999) and others that there are superiority phenomena, but I would like to argue neither the superiority condition nor the tucking-in op-
relation is required to capture the observed order of *wh*-words in Bulgarian.

Let’s examine the relevant aspects of the derivation of (19a). At some point of the derivation, NS has constructed the following CP phase, in which the last resort operation (13) (merging *v* to *vP*) and the transfer operation (removing VP from the “workspace” of NS) have taken place (note that *koj* is taken to be a complex/non-head SO, triggering (13), but this assumption does not affect the discussion below):

(20) \{C, \{T, \{kogo, \{v, \{koj, \{v, VP\}\}\}\}\}\}\}\}\}

In (20), unvalued phi is transmitted to T from C, but Agree (T, *koj*) cannot take place, because (i) *kogo* (bearing valued phi) is in the search domain of T, and (ii) *kogo* is higher than *koj* is, i.e., the occurrence of *koj* (= \{v, VP\}) is a distinct SO contained by the occurrence of *kogo* (= \{v, \{koj, \{v, VP\}\}\}) (see section 5). Under the probe-goal theory of agreement, the phi on T would match the phi on *kogo* first and never get to the phi on *koj*. To circumvent this “first match” intervention (incorporated in the probe-goal theory of agreement), IM (driven solely by the EF of C) must raise *kogo* to Spec-C (prior to Agree (T, *koj*)), forming (21):

(21) \{kogo, \{C, \{T, \{kogo, \{v, \{koj, \{v, VP\}\}\}\}\}\}\}\}\}

In (21), Agree (T, *koj*) can value the phi on T and the Case on *koj*, because the search domain of T no longer properly contains *kogo*. In effect, IM of *kogo* to Spec-C turns *kogo* into a “discontinuous” element; hence, it no longer intervenes between T and *koj* (see Chomsky (2007, 2008)).

Now suppose that Agree (T, *koj*) is accompanied by IM (a residue of EPP). Then, this “counter-cyclic” IM raises *koj* to Spec-T, forming (22); and in parallel with this “counter-cyclic” subject-raising, IM (driven solely by the EF of C) raises *koj* to Spec-C, forming (23):

(22) \{koj, \{T, \{kogo, \{v, \{koj, \{v, VP\}\}\}\}\}\}\}\}

(23) \{koj, \{kogo, \{C, \{T, \{kogo, \{v, \{koj, \{v, VP\}\}\}\}\}\}\}\}\}\}

These two applications of IM take place simultaneously, yielding two intersecting SOs, namely (22) and (23) (see the discussion regarding “counter-cyclic” Spec-TP creation in section 5).

Now notice that, as shown in (23), the observed order of *wh*-words, *koj kogo*, in the edge of the CP phase is deduced with no additional stipulation. That is, for Bulgarian data such as (19a, b), the probe-goal theory of agreement predicts the observed order of *wh*-words. Neither the superiority condition nor the tucking-in operation is required to explain this particular order of *wh*-words. It is important to note in particular that the tucking-in operation, which would induce a form of replacement, can be eliminated in favor of the probe-goal theory of agreement (incorporating “first match” in-
tervention).

9. Summary

Under the strong minimalist thesis, we expect FL to be a “perfect system,” meeting the interface conditions in a way satisfying third factor principles. The hypothesized third factor principles include probe-goal and minimal search conditions. These have enjoyed increased prominence in recent minimalist theorizing, and in some areas they produce interesting results, as discussed in the preceding sections. One important consequence of NS equipped only with Merge \((X, Y) \Rightarrow \{X, Y\}\), identified in this paper, is the loss of the main empirical difference between the two distinct approaches to syntactic relations, Epstein et al.’s (1998) derivational approach and Chomsky’s (2000) compositional approach. Chomsky’s (2007, 2008) suggestion that c-command is eliminable in favor of probe-goal and minimal search conditions opens a new line of research into this matter. If probe-goal and minimal search conditions are sufficient to characterize not only the empirically desirable aspects of c-command but also other syntactically significant relations, then any further characterization of such relations would appear to be superfluous. We do not know how far this line of inquiry can take us, but in my view, we have already gained some insights, and I suspect more will come from continuing to investigate the validity of this very surprising, hence intriguing, argument.

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[received September 30 2010, revised and accepted February 6 2011]

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