# D-2 Labeling under minimal search: Determining "single- vs. multiple-specifier" configurations

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*Building on recent work of Chomsky (2013), this paper has two central points. The first is that the composite operation Agree, employing both probe-goal search and feature-valuation, can be eliminated from the narrow syntax (NS), replaced with just (i) 3rd factor minimal search (independently necessary for labeling), and (ii) a certain natural conception of how features are interpreted at the interfaces. Consonant with the strong minimalist thesis, we attempt to simplify the NS, adopting only simplest Merge and the 3rd factor principle of minimal search. Our second point is that with a natural interpretation of how minimal search operates, not only is the theory simpler, but in fact has greater empirical coverage, accounting for central properties of "multiple-specifier" phenomena in Japanese.*

Chomsky (2013) proposes a new conception of the narrow syntax (NS) which generates neither linear ordering nor projection. Composition and displacement are unified as two possible instantiations of the single operation Merge, which simply puts two objects α and β into a relation by forming the set {α, β}. Nothing more. Merge, formulated in this simplest form, applies freely as long as it conforms to 3rd factor principles, but its application does not generate a categorial node as the label of the set {α, β}. For a syntactic object SO to be interpreted by the interpretive systems, however, it is necessary to know what kind of object it is (e.g., nominal, verbal, etc.). Chomsky (2013) takes labeling to be the process of finding the relevant information of {α, β}, generated by Merge; such labeling is taken to be "just minimal search, presumably appropriating a 3rd factor principle, as in Agree and other operations." Thus, a dedicated symbol of mental representation denoting categorial status of phrases is no longer stipulated as part of axiomatic phrase structure generating laws, or schema, but is rather determined by minimal search which identifies categorial status when applied to such label-free representations.

Chomsky (2013) discusses the following two cases. Suppose SO = {H, XP}, H a head and XP not a head. Then minimal search selects H as the label of {H, XP}; it finds both members of the set, but H bears prominent features that can serve as a label; the other is just a set (e.g., {V, NP}is verbal because minimal search selects V as its label). Suppose SO = {XP, YP}, neither a head. Here minimal search is ambiguous, locating both the head X of XP and the head Y of YP, and the ambiguity is assumed to be intolerable (the label of SO is not uniquely determined). Chomsky (2013) then proposes two ways in which SO can become labeled: (A) modify SO by movement, so that there is only one visible head, assuming movement leaves an invisible copy, or (B) X and Y are identical in a relevant respect, e.g. they bear syntactically identical features, providing the same label, e.g. the *shared* features that have undergone Agree, which can be taken as the label of the SO.

This paper, building on the ideas of Chomsky 2013 reviewed above, consists of two parts: First, we point out two problems confronting Chomsky's (2000, 2001) formulation of Agree, a formulation that is carried over into more recent work, as a composite operation involving both probe-goal search and feature-valuation. We then seek to eliminate Agree by: (i) replacing probe-goal search with minimal search (as defined in Chomsky 2013, 2015) and (ii) removing feature-valuation from the NS and reassigning it to the morpho-phonological component (cf. Bobaljik 2008). We demonstrate that X bearing unvalued features (*u*F) and Y bearing valued features (*v*F) will appear convergently only where minimal search finds X and Y *simultaneously*, and after transfer, based on the information provided by these two heads, the relevant valued morpho-phonological

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features are assigned to *u*F in the morpho-phonological component (see Epstein, Kitahara, and Seely 2018). Thus, Agree is not a syntactic transformation altering feature values from unvalued to valued in the NS. Rather we propose a configurational analysis of Agree whereby *u*F does not cause crash, if in sufficient proximity to *v*F; i.e., minimal search finds the *v*F/*u*F pair simultaneously. Second, we examine so-called "multiple-specifier" configurations (e.g. Japanese multiple nominative subjects, see among others, Kuno 1973), which poses a potential problem for Chomsky's (2013, 2015) labeling analysis (first noted by Sorida (2014)). To resolve this problem, we clarify and present an arguably most efficient interpretation of how minimal search works in the NS, and extend the proposed labeling analysis, which replaces Agree with minimal search, to the configurations in question.

## 1. Replacing Agree with minimal search

In this section, we first point out two problems confronting Chomsky's (2000, 2001) formulation of Agree, and then seek to eliminate Agree by (i) replacing probe-goal search with minimal search and (ii) removing feature-valuation (a transformation mapping one NS representation (containing *u*F) into a different NS representation (with *u*F changed to *v*F)) from the NS, and reassigning it to the morpho-phonological component.

### 1.1 Problems with Agree

Under Chomsky's (2000, 2001) formulation of Agree, a head bearing unvalued features is taken to be a probe that seeks within its search domain a goal bearing matching features that establish agreement, as illustrated in (1):

(1) T-be elected [$_{\alpha}$ an unpopular candidate]

In (1), T bearing *u*Phi is the probe P that seeks a goal G in its search domain (i.e. the terms of the set of which P is a member). Informally speaking, T searches and finds *candidate* bearing *v*Phi. By locating G, *u*Phi on P gets valued, and *u*Case on G gets valued as a "reflex." So, Agree is a composite operation consisting of (i) probe-goal search (locating P and searching for and finding G in the search domain of P) and (ii) feature-valuation (of P and of G).

There are at least two problems confronting Agree. First, Chomsky (2015) assumes strict cyclic derivations: subject raising (IM of EA to Spec-T) and object shift (IM of IA to Spec-R) take place before C and v enter the derivations, respectively. In this way, countercyclic derivations are (crucially) avoided (see Epstein, Kitahara, and Seely 2012 for extensive discussion of the need to avoid such countercyclicity). Thus, in [C [EA [T [EA [v ...]]]], with derivational steps [T [EA [v ...]]]→[EA [T [EA [v ...]]]→[C [EA [T [EA [v ...]]]], by the time T inherits *u*Phi from C, EA has already moved out of the search domain of T; EA must move before C is merged, otherwise the derivation would be countercyclic. But now P's (= T's) search for G (= the lower copy of EA) in fact fails because the lower copy of EA is invisible to probing P (following Chomsky 2013). The parallel problem holds for the vP phase; thus, all EA/IA raising (each required for labeling) in fact crashes.

Epstein, Obata, and Seely (2016) and Chomsky (2016) independently suggest that this problem can be circumvented if C first agrees with cyclically introduced EA in Spec-T (which is visible to C), and C then transmits its now syntactically valued Phi to T; similarly, v first agrees with IA in Spec-V and then transmits its now syntactically valued Phi to V. But there is another problem for the probe-goal formulation of Agree that cannot be circumvented by changing the order of rule-applications.

Chomsky (2013, 2015) discusses three instances of feature-valuation: (i) *u*Phi, (ii) *u*Case, and (iii) *u*Q. As for uQ, he proposes that interrogative $C_Q$ values uQ on a *wh*-expression, drawing data from English. Clear evidence for this also comes from Japanese. Saito (2013, 2017) argues that a *wh*-expression is an operator whose quantificational force is determined by $C_Q$ particles such as *ka* and *mo,* as illustrated in (2a,b):

(2) a. Taroo-wa [[Hanako-ga nani-o tabeta] ka] sitteiru
Taroo-Top Hanako-Nom what-Acc ate Q know
'Taroo knows what Hanako ate.'

b. [[Nani-o tabeta hito] mo] manzokusita
what-Acc ate person also was.satisfied
'For every x, x a thing, the person that ate x was satisfied.'

For Saito, in (2a), the disjunctive meaning of *ka* turns the *wh*-expression *nani* 'what' into a *wh*-quantifier; in (2b), the conjunctive meaning of *mo* turns *nani* 'what' into a universal quantifier. Extending Saito's analysis of (2a,b) to English, we expect that a particular $C_Q$'s valuation of *u*Q on a *wh*-expression determines (or can determine) aspects of the interpretation of that *wh*-expression; i.e., the unvalued Quantifier feature (*u*Q) on a *wh*-expression gets valued by some inherent property borne by the interrogative $C_Q$ (similarly for non-quantificational force of relative pronouns and perhaps free relatives and exclamatives). But, this feature-valuation analysis of *wh*-expressions poses a serious problem for Agree. Consider (3), where now the *u*Q is a probe P, and it is the $C_Q$ that is the goal G:

(3) [[which$_{uQ}$ dog] [$C_Q$ β]] (where *u*Q of *which* is Probe P, and $C_Q$ is Goal G)

Notice, in (3), P's (= *which*$_{uQ}$) search of G (= $C_Q$) fails because it is P that bears *u*F, and there is no relevant G in P's search domain: the probing head *which*$_{uQ}$ embedded within the DP *wh*-expression *which dog* does not find $C_Q$ because the set of which the probing head *which*$_{uQ}$ is a member, namely the DP *wh*-expression *which dog*, does not contain $C_Q$ as its term. Note that if, as desired, there is no feature percolation (nor representational label projection, see Chomsky 2013, and also Collins 2002, Seely 2006 for earlier proposals), then there is no way, under such bare phrase structures, for the *wh*-expression "which dog" to probe and find interrogative $C_Q$ (contra Bošković 2007).

We now provide a simple and unified solution to all the problems discussed above, one appealing to a new form of minimal search that we propose, while removing Agree together with probe-goal search from the NS.

## 1.2 Toward a solution

We propose first that the same minimal search operative for labeling (i.e. finding the first head(s) for labeling, see Chomsky 2013, 2015) also operates for agreement, thereby allowing the elimination of probe-goal search. Recall that minimal search comes "for free" by third factor, and it simultaneously finds the two heads X and Y in the so-called XP-YP configurations. We propose that two such heads, configurationally available for labeling, are by definition syntactically accessible, and we propose that "valuation" takes place only between such syntactically accessible heads. Consider (4a-c), which correspond to the structures for subject-raising (4a), object-shift (4b), and *wh*-movement (4c), respectively:

(4) a. [C [EA [T$_{uPhi}$ ... ]]] (subject-raising)
b. [v [IA [R$_{uPhi}$ ... ]]] (object-shift)
c. [WH$_{uQ}$ [$C_Q$ ...]] (*wh*-movement)

In (4a), minimal search simultaneously finds the nominal head of EA and T$_{uPhi}$, and, speaking informally, we say that "valuation" takes place between these heads, and *u*Case on EA gets valued as a "reflex" of this process. Likewise, in (4b), minimal search simultaneously finds the nominal head of IA and R$_{uPhi}$, and "valuation" takes place. Finally, in (4c), minimal search simultaneously finds the head (bearing *u*Q) of the *wh*-expression and

the interrogative $C_Q$, and "valuation" takes place between these accessible heads. Notice that such XP-YP configurations are the only ones where minimal search finds the heads X and Y simultaneously. Thus, the proposed analysis predicts that the two heads that undergo "valuation" must be in the XP-YP configuration. This suggests (i) an expletive *there* does participate in phi-agreement by first merging *there* and its associate NP, valuing *u*Phi on *there,* then moving *there* to Spec-T, finally valuing *u*Phi on T, see Abe, 2018, Goto 2017) and (ii) a *wh*-expression invariably moves to Spec-$C_Q$, but those *wh*-in-situ languages (e.g. Japanese) have an option of externalizing a (lower) copy in situ (see Saito 2013, 2017, and also Watanabe 1992 for an earlier proposal).

Let us now move to the feature-valuation part of Agree. Valuation is empirically motivated, but we argue that a natural place for it is the morpho-phonological component, not the NS (cf. Bobaljik 2008). Suppose, for a syntactic object SO, minimal search simultaneously finds two heads: one bearing valued features (*v*F), the other bearing unvalued features (*u*F). Then, the total information provided by these heads is just *v*F (since *v*F is in effect superimposed on *u*F, analogous, for purposes of illustration, to "1+0=1") and *v*F is uniquely identified as the label of SO (Chomsky 2013, 2015). Furthermore, if such information, namely *v*F, is sufficient for the assignment of the relevant morpho-phonological features to *u*F (or configurationally interpreting *u*F when in this minimal search relation to *v*F), then it is redundant to have "feature-valuation" (i.e. "transforming" *u*F to *v*F) in the NS prior to "feature-value assignment" (or interpretation of *u*F-*v*F in a minimal search relation) in the morphological component. Following Chomsky (1995), we assume that "there is no reason to suppose that the mechanisms of language include superfluous devices and rules to achieve, redundantly, the same result in special cases." Given this, we suggest that the feature-value assignment to *u*F (perhaps interpretive assignment) in the morpho-phonological component should be retained, while the feature-valuation of *u*F in the NS should be eliminated, as the strong minimalist thesis expects (provided that feature-valuation in the NS may violate the no-tampering condition).

To illustrate how the NS works, consider the following case "the boy admires his dog." After EA raising, minimal search simultaneously finds the nominal head of EA bearing *v*Phi (3rd person, singular, masculine) and the T bearing *u*Phi. The total information provided by these two heads is just *v*Phi (3rd person, singular, masculine), and *v*Phi is taken to be the label of [EA [T $\alpha$]]. After transfer, the relevant morpho-phonological features are assigned to *u*Phi on T, based on the configurational information available (namely, *v*Phi in a minimal search relation to *u*Phi, and vice versa), which, recall, results from freely available minimal search; and such feature-assignment/valuation takes place in the morpho-phonological component, not in the NS. Note that if T bearing *u*Phi happens to be standing alone, then T bearing *u*Phi remains visible as it is, and there is no relevant information concerning the values of Phi; hence, *u*Phi on T will induce a problem; it is taken to be an element intolerable to the SM interface systems (which provides insufficient instructions as to whether to externalize e.g. English "T-be" bearing *u*Phi as "is" or "are", see Chomsky 2000, 2001).

To summarize, under the strong minimalist thesis, the following general picture emerges: the "perfect system" is one that meets the interface conditions, and one that consists of *Simplest Merge* and *Minimal Computation*, which involves notions like minimal search. In this section, we argued that the composite (hence, non-primitive, non-minimal) operation Agree is eliminable from the NS. Under current assumptions, it follows that X bearing *u*F and Y bearing *v*F will appear convergently only where minimal search finds X and Y simultaneously, and after transfer, based on the information provided by these two heads, the relevant morpho-phonological features are assigned to *u*F in the morpho-phonological component.

## 2. Clarifying labeling under minimal search

In this section, we extend the proposed labeling analysis, which now subsumes Agree, to so-called "multiple-specifier" configurations, which requires a further clarification of how exactly minimal search works.

2.1 A potential problem with the labeling analysis replacing Agree with minimal search

Japanese exhibits so-called "multiple-specifier" configurations. Take a concrete case (5), a Japanese multiple nominative subject (see among others, Kuno 1973), with its structure (6) (where indices are used only for expository purposes):

(5) Bunmeikoku-ga dansei-ga heikin-zyumyoo-ga mizikai
civilized.country-NOM male-NOM average-life.span-NOM short-Pres.
'It is in civilized countries that male's average life span is short.'

(6) [$NP_1$ [$NP_2$ [$NP_3$ [vP T]]]]

Suppose that $NP_1$, $NP_2$, and $NP_3$ occupy so-called "specifiers" of T. Then, under the Merge-based analysis, (5) is assigned the following structure (where $N_1$, $N_2$, $N_3$, T are heads, and $\alpha$, $\beta$, $\gamma$, vP not heads):

(7) {{$N_1$, $\alpha$}, {{$N_2$, $\beta$}, {{$N_3$, $\gamma$}, {vP, T}}}

Here we have a potential problem. So far, following Chomsky (2013, 2015), we have been assuming that minimal search finds the first head(s) for labeling. But what counts as the first head(s) in (7) is not clear. (7) is an XP-YP configuration, but it has more structures. From the top-down search, one might argue that $N_1$ should count as the first head because $N_1$ is structurally higher than any other heads (a problem first noted by Sorida (2014)). But that would fail to explain why nominative case appears on each of the three nominal phrases. What we want minimal search to find in (7) is the three nominal heads $N_1$, $N_2$, $N_3$, and the finite T, so that the "valuation" of Case on each NP will take place (assuming nominative to be the Case of finite T). So, the task we face is to clarify how minimal search locates those four heads simultaneously.

2.2 Toward a solution

To solve the potential problem posed by (5), we propose the following arguably most efficient form of minimal search (see Ke 2019 for a detailed formal analysis of the nature of minimal search), and demonstrate how minimal search locates the four heads in question.

(8) *Minimal Search*
In a top-down fashion, minimal search for $\alpha$ selects $\alpha$, and terminates further search of the terms of the set of which $\alpha$ is a member.

This new form of minimal search, like the preceding one, going from top-down, finds $\alpha$ and terminates further search, but not necessarily the entire search process; rather it terminates further search of the terms of the set of which $\alpha$ is a member. Metaphorically, we might think of it as like the flow of electricity; the current flows to each room of my house equally, but within each room the current can be shut off; this, however, does not affect the current flow in other rooms. Informally speaking, each branch of one big search naturally doesn't know what the other branch is doing, and so each branch continues search. So, in the XP-YP configuration, one search branch goes into XP and one search branch goes into YP, and neither cares what the other is doing in that if the XP search finds a head, the YP search still continues. Once search looks into one branch XP, it would be a complication for search to know what is happening in the other search YP. The simplest search just proceeds into both XP and YP, treating each search branch independently.

Let's examine how minimal search, formulated in (8), works for the two cases discussed in Chomsky (2013,

2015) and the problematic case (7), assigned to (5). Suppose SO = {H, α} (H a head and α not a head). Then minimal search for head(s) selects H as the label, and terminates further search of the terms of the set of which H is a member (i.e., α is located, but there is no further search of its terms). Suppose SO = {{X, α}, {Y, β}} (X, Y heads, and α, β not heads). Then minimal search for head(s) selects X and Y, and terminates further search of the terms of the set of which each head is a member (i.e., α and β are located, but there is no further search of their terms). Suppose SO = {{$N_1$, α}, {{$N_2$, β}, {{$N_3$, γ}, {vP, T}}}} ($N_1$, $N_2$, $N_3$, T heads and α, β, γ, vP not heads). Then minimal search for head(s) selects $N_1$, $N_2$, $N_3$, and T, and terminates further search of the terms of the set of which each head is a member (i.e., α, β, γ, and vP are located, but there is no further search of their terms). We argue that those selected heads in the "single- and multiple-specifier" configurations provide uniquely identifiable features, which can be taken as the label of the SO: phi for English "single-specifier" {{X, α}, {Y, β}}, or nominative for Japanese "multiple-specifiers" {{$N_1$, α}, {{$N_2$, β}, {{$N_3$, γ}, {vP, T}}}}).

The proposed analysis also predicts that there must be one and only one valuing head in the "single- and multiple-specifier" configurations. Notice, in multiple nominative subject (5), T values unvalued Cases of $N_1$, $N_2$, and $N_3$. But if T had unvalued phi, then $N_1$, $N_2$, and $N_3$ would each participate in phi-agreement with T as a distinct valuer, and phi-valuation would collapse, because $N_1$, $N_2$, and $N_3$ bear distinct phi-sets (even if they bore accidentally identical valued phi-features, they would not count as a unique label. see Chomsky 2013, 2015). Thus, it follows that multiple nominative subject (5) is possible only if there is no *u*Phi on T (cf. Kuroda 1988, Saito 2016, Sorida 2014), and Case-valuation cannot be a "reflex" of phi-agreement (contra Chomsky 2000); the former is independent from the latter. What separates Japanese (allowing "multiple specifiers") from English (forcing a "single-specifier") is the absence of *u*Phi in Japanese. The "single- vs. multiple-specifier" variation reduces to the presence or absence of *u*Phi; it is *u*Phi on T that blocks "multiple-specifiers" because phi-valuation would collapse if there were two or more valuing categories with *v*F for one category with *u*F.

Furthermore, we argue that the proposed analysis renders dispensable Chomsky's (2013) stipulation concerning the invisible status of lower copies (i.e., α is in the domain D if and only if every occurrence of α is a term of D). Suppose SO = {XP, {T, {XP, vP}}} (where XP undergoes subject-raising). Then, in a top-down fashion, minimal search for XP selects the higher copy of XP, and terminates further search of the terms of the set of which the higher copy of XP is a member. Thus, the invisible status of the lower copy of XP follows under minimal search; the lower copy of XP is no longer accessible to subsequent operations (Merge, Agree, and labeling). If such lower copies were visible and accessible, then the problem of determinacy, discussed by Chomsky, Gallego, and Ott (2019), would arise. They argue that under minimal search, the two core applications of Merge, External and Internal Merge, do not increase the accessibility, but all other applications of Merge including Parallel Merge, Sideward Merge, and Late Merge all induce a determinacy problem by failing to restrict the number of accessible copies to the minimum, namely one (see Chomsky 2019 MIT Lectures).

## 3. Conclusion

This paper makes two central proposals. One is that the composite operation Agree, as probe-goal search plus feature-valuation, can be replaced with the independently necessary, and 3rd factor relation, of minimal search. This results in a significant reduction in the inventory of theoretical postulates in the NS. The second proposal is that when combined with a natural conception of how minimal search operates (namely, that at any given *local point*, once search finds a head with relevant features it ceases to search further *at that local point*), the system overall not only simpler (conforming with the strong minimalist thesis) but actually results in an increase in empirical coverage, accounting for central properties of "multiple-specifier" phenomena in Japanese. We suggest that these are welcome results, both conceptually and empirically.

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