F-7 Can "Determinacy + PIC" explain descriptions of Remnant Movement Asymmetries?

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Chomsky et al. (2017), following a series of his latest lectures (held at the University of Arizona, MIT, and the University of Reading in 2017), propose that simplest unified MERGE does not operate directly on syntactic objects but rather on the Workspace (WS) — the set of syntactic objects that include lexical items (LIs) and those objects already constructed, the members and terms of which are available for computation. This reconceived form of MERGE operates in accord with 3rd factor, i.e. language-independent laws of nature, including the 3rd factor principle of Minimal Search (which we characterize below). One question that arises for this new conception of MERGE is this: when MERGE(X, Y, WS) applies to the WS = [X, Y] adding the newly-created {X, Y} to WS (where X, Y are LIs or sets), does the set {X, Y} replace X and Y, yielding WS' = [{X, Y}]; or do X and Y remain, yielding WS" = [X, Y, {X, Y}]?

A crucial difference between WS' (i.e. eliminating the merged items from the output WS') and WS" (i.e. retaining the merged items in the output WS") is that accessible copies appear only once in WS' but more than once in WS", and the latter would not ensure that subsequent rules apply in a determinate fashion, because any rule referencing X or referencing Y (or referencing each of the two) would ambiguously refer to the individual objects X, Y or to the members of the set {X, Y}. Conjecturing that such ambiguity is (naturally) not tolerated, Chomsky et al (2017) hypothesize that MERGE is well-defined, as a function *with a determinate output*. In other words, MERGE has no choice but to apply in accord with Determinacy, yielding WS' (and not WS"). It follows, then, that if MERGE applies to the WS = [X, Y], creating the new set {X, Y}, then the new set {X, Y} is added to the output WS, but the elements X, Y are removed, yielding the output WS' = [{X, Y}].

Following Chomsky et al. (2017), we assume that Determinacy belongs to 3rd factor (not stipulated as a uniquely linguistic (UG) constraint); hence, 3rd-factor-constrained MERGE has no choice but to limit accessible copies to one and only one throughout the course of a derivation; i.e. in a given WS there is at most one and only one accessible copy, among all the terms appearing in that WS. Adopting the 3rd factor principle of Determinacy (that governs MERGE, employing Minimal search) delimited by the Phase Impenetrability Condition (PIC), rendering certain copies inaccessible to Merge, hence ignored in Determinacy assessments, *we argue that Takano-Müller's influential but currently unformulable (descriptive) constraint (TMC) regarding remnant movement (RM) is deducible from the interaction of these independently motivated 3rd*

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factor principles. TMC states that in an RM derivation yielding the configuration [... [$_X$ ... t_1 ...]$_2$ ... Y_1 ... t_2 ...], movement of Y and movement of X may not be of the same type, see Takano 1994, 2000, 2015, Müller 1996 and see also Saito's (2003) important counterexample to it, discussed below. We suggest that TMC follows deducibly and without (linguistic-specific) stipulation from 3rd factor compliant MERGE operating in accord with the 3rd factor principles of Determinacy and PIC.

First, consider the deviance of the following three core remnant movement cases (see among others, Saito 1989, 1992, 2003, Takano 1994, 2000, 2015, Müller 1996, and Hiraiwa 2010). Consider (1) (where Y = *Tokyo-ni* moves to "TP adjoined" position, and then remnant movement of X = *[Hanako-ga t_1 sundeiru to]* takes place to "TP adjoined" position):

(1) a. * [Hanako-ga t_1 sundeiru to]$_2$ Tokyo-ni$_1$ Taroo-ga t_2 omotteiru
Hanako-NOM live C Tokyo-in Taroo-NOM think

b. [$_{TP}$ [$_X$ ... Y_1 ...]$_2$ [$_{TP}$ Y_1 [$_{TP}$ ... T ... [$_X$ ... Y_1 ...]$_2$ ...]]]

i. [$_{TP}$ ... T ... [$_X$ ... Y_1 ...]$_2$ ...]
ii. [$_{TP}$ Y_1 [$_{TP}$ ... T ... [$_X$ ... Y_1 ...]$_2$ ...]]
iii. [$_{TP}$ [$_X$ ... Y_1 ...]$_2$ [$_{TP}$ Y_1 [$_{TP}$ ... T ... [$_X$ ... Y_1 ...]$_2$ ...]]]

In mapping (1i) to (1ii), Y = *Tokyo-ni* is first scrambled ("TP adjoined") out of X in the lowest TP. Subsequently, in mapping (1ii) to (1iii), X (containing a Y-copy) is itself scrambled and is also "adjoined" to TP. These scrambling operations (both targeting matrix TP) are each (in principle) executable under MERGE, but the two copies of Y appearing in the edge of T are both accessible terms, i.e. they constitute two accessible identical copies, thereby violating the computationally natural 3rd factor principle of Determinacy, i.e. such an output of MERGE would be fundamentally flawed in that it has more than one copy of Y = *Tokyo-ni*. (Below we will return and discuss the status of the lowest copy of Y in detail.)

Consider (2):

(2) a. * [PRO t_1 ikukoto]-ga$_2$ Sooru-made$_1$ Taroo-ni t_2 meizirareta
go C-NOM Seoul-to Taroo-DAT was.ordered

b. [[$_X$ ... Y_1 ...]$_2$ [T [Y_1 [... [$_X$ ... Y_1 ...]$_2$ ...]]]]

i. [... [$_X$ ... Y_1 ...]$_2$ ...]
ii. [Y_1 [... [$_X$ ... Y_1 ...]$_2$ ...]
iii. [T [Y_1 [... [$_X$ ... Y_1 ...]$_2$ ...]]]
iv. [[$_X$ ... Y_1 ...]$_2$ [T [Y_1 [... [$_X$ ... Y_1 ...]$_2$ ...]]]]

(2) is RM, like (1). But unlike (1), the two movements are of different types, Y-movement is scrambling, but X-movement is NP-movement. Saito (2003) argues that (2) therefore incorrectly escapes application of TMC, providing a direct counter-example to the TMC. Under the alternative approach we are presenting here, these two movement operations are each executable, but the two copies of Y = *Seoul-made* in the resulting structure are accessible terms, thereby violating Determinacy and the unwanted structure is ungenerable by 3rd factor (Determinacy compliant) MERGE. In this particular case then, the far more general, simple, hence arguably explanatory approach, appears empirically preferable.

Consider (3):

(3) a. * [which picture of t_1]$_2$ does John wonder who$_1$ Mary likes t_2

b. $[_{CP}\ [_X \dots Y_1 \dots]_2\ [\ Y_1\ [\ C \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]\ ]$

i. $[\ C \dots [_X \dots Y_1 \dots]_2 \dots]\ ]$

ii. $[_{CP}\ Y_1\ [\ C \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]$

iii. $[_{CP}\ [_X \dots Y_1 \dots]_2\ [\ Y_1\ [\ C \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]\ ]$

The remnant movement depicted in (3) is similar to (1) and (2) in that it extracts Y from X and then extracts the remnant X (containing a copy of Y). Given PIC, Y and X must both move to the edge of the embedded CP, as shown in (3iii), but the two copies of Y in the embedded CP's edge are accessible terms, violating Determinacy. (Note that given the (also 3rd factor) No-Tampering Condition (NTC), there is no choice but to leave copies, (when IM, but not EM, applies) some of which are rendered inaccessible by the PIC.)

(1), (2) and (3) are deviant cases, correctly disallowed by Determinacy; in each instance two copies of a merged element remain accessible to MERGE. But now, how is good RM (and good phase-internal IM, with at least 2 accessible copies necessarily appearing) *ever* allowed? Consider first good RM (4):

(4) a. (I wonder) [how likely to t_1 win]$_2$ John$_1$ is t_2

b. $[_{CP}\ [_X \dots Y_1 \dots]_2\ [\ C\ [_{TP}\ Y_1\ [\ \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]\ ]\ ]$

i. $[\ \dots [_X \dots Y_1 \dots]_2 \dots]$

ii. $[_{TP}\ Y_1\ [\ \dots [_X \dots Y_1 \dots]_2 \dots]\ ]$

iii. $[\ C\ [_{TP}\ Y_1\ [\ \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]$

iv. $[_{CP}\ [_X \dots Y_1 \dots]_2\ [\ C\ [_{TP}\ Y_1\ [\ \dots [_X \dots Y_1 \dots]_2 \dots]\ ]\ ]\ ]\ ]$

Here, Y moves out of X to Spec-T, and then the wh-phrase X (containing a Y-copy) moves to Spec-C. TMC allows this, since the two moves are of different types. Now notice, here too the two copies of Y appear as accessible terms. So, how does this representation evade a violation of Determinacy?

One natural answer to this question is to appeal to the independently motivated (and also computationally natural, in part 3rd factor principle) PIC, defined as follows: In phase P with head H, the domain of H is not accessible to operations outside P, and only H and its edge are accessible to such operations (Chomsky 2000). Thus, upon phase completion, the phase-head-complement (PHC) becomes inaccessible to further operations. We assume C and v to be phase-heads. Given PIC, Determinacy, in fact, correctly allows (4iv). The WS appears as $[_{CP}$ $[_{X}$ ... Y_1 ... $]_2$ [C ~~{PHC}~~]], where only one copy of Y appears as an accessible term (in the edge of embedded C). Determinacy is satisfied, i.e. there is no ambiguity in further applying MERGE since only one (MERGE-) accessible Y-copy appears.

So, PIC renders a lower copy left by phase-crossing movement inaccessible. But, what about a lower copy left by phase-internal movement? In mapping (4i) to (4ii), Y moves to Spec-T (i.e. subject raising, an instance of phase-internal NP-movement; similar reasoning holds for passive), and here too the two copies of Y appear. How does this representation evade a violation of Determinacy?

In his labeling analysis, Chomsky (2013) stipulates α to be in the domain D if and only if every occurrence of α is a term of D. This stipulation accounts for why a lower copy of α is invisible for the labeling of a domain that fails to contain every occurrence of α, but the stipulation itself remains unexplained. Here, we ask: Is there any way to derive the desirable effects of Chomsky's (2013) stipulation and the (desired) inaccessibility of a lower copy left by phase-internal movement?

One possible answer to this question is to include the Shortest Move Corollary (SMC) as a subpart of minimal search, (a version of which was suggested by Noam Chomsky (personal communication)); i.e. given two options, the shorter "move" prevails; for example, in (4ii) = $[_{TP}$ Y_1 [... $[_{X}$ ... Y_1 ... $]_2$ ...]], there are two copies of Y, but the SMC selects the higher copy of Y, because a path terminating with the higher copy of Y is a subpart of a path terminating with the lower copy of Y; "shorter" means properly contained in.

To be concrete, consider $\{x_1, \{y, \{z, x_2\}\}\}$, where x_1 and x_2 are two copies formed by phase-internal movement; the subscript numerals are assigned just for expository purposes. Let $A=\{x_1, \{y, \{z, x_2\}\}\}$, $B=\{y, \{z, x_2\}\}$, $C=\{z, x_2\}$, and the path of x is a maximal set of terms of which x is a term. (Note the non-reflexive definition of term is adopted here.) Given this much, A is the sole member of the path terminating with x_1, whereas A, B, C each count as a member of the path terminating with x_2. Thus, $\{A\} \subset \{A, B, C\}$, and under SMC, x_1 renders x_2 inaccessible.

Returning to (4ii) = [$_{TP}$ Y_1 [... [$_X$ ... Y_1 ...]$_2$ ...]], on computational efficiency grounds then, the higher copy of Y is selected over the lower copy of Y; as a result, the higher copy of Y is the one and only one accessible copy of Y. Note that there is no need to stipulate that the head of a chain is visible, while the tail of a chain is not; such effects just follow from SMC. Likewise, Chomsky's (2013) stipulation (i.e. α is in the domain D if and only if every occurrence of α is a term of D) is dispensable. The inaccessible status of lower copies for labeling similarly follows from SMC.

Chomsky (personal communication) suggests: "Labeling is a search procedure, like Agree (and in fact Merge, which searches for things to merge). So why isn't it enough to say that all search procedures are governed by the third factor principle of economy (shortest search)." Following Chomsky's suggestion, we include SMC as an instance of 3rd factor Minimal Search.

As shown above, the four core cases of remnant movement asymmetries, exhibited by (1), (2), (3) and (4), receive a MERGE-based explanation under Determinacy, PIC and Minimal Search (including SMC), each of which is by hypothesis at least in part a third factor principle (including MERGE itself which is binary and subject to the NTC and the Inclusiveness Condition). There is apparently no need to appeal to descriptive types of movement (such as A-/A'-movement, or scrambling or NP-movement). This is a welcome result since under the simplest unified MERGE hypothesis, such distinct types of movement are not specifiable. Thus we seek a far simpler, hence more explanatory theory (see Epstein et al. 2017) — explanation being the very goal of scientific theory formation — with equal or better empirical coverage than (important) prior descriptive and (far more) language specific accounts. Such Minimization of UG, as Chomsky notes, is a desirable goal also with respect to (at least currently available) explanation at the evolutionary level.

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