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Generative Procedure Revisited*

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I. A System of Discrete Infinity

(1) Seven Desiderata (Chomsky 2017)

(i) Descriptive Adequacy

[a good guideline to proceed]

(ii) Strong Minimalist Thesis

[e.g. no-tampering, inclusiveness, phase-impenetrability]

(iii) Determinacy

[accessible terms only appear once in workspace]

(iv) Restrict Computational Resources

[MERGE should never expand workspace]

(v) Stability

[SO can't change its interpretation (or status) in the course of a derivation]

(vi) Recursion

[SO, once generated, remains accessible to further application of MERGE]

(vii) Strictly Binary

[i.e. two and only two SOs can be affected by MERGE]

(2) A Workspace (Chomsky 2017)

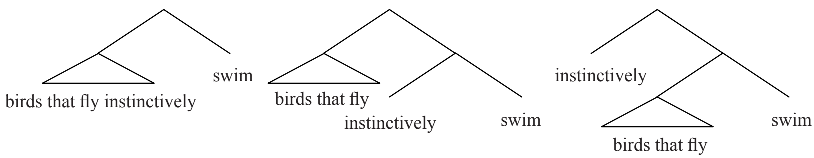
Language is a system of discrete infinity. Therefore, it is a computational system with a set LEX of atomic elements (indivisible for the computation, but analyzable in other terms) and a computational process CP. Uncontroversially, we seek the simplest CP and keep to it unless empirical phenomena require something more. The simplest CP takes two objects already formed and yields a new one, without modifying them or adding anything new: essentially set formation (Merge). [...] Human language has other properties. In particular, it has endocentric constructions [and] Z = {XP, YP} structures where XP and YP have to be constructed independently (subject-predicate, etc.). Merge alone can't get them. It must be the case that SOs are constructed in parallel (meaning independently), and bring them together somewhere. That requires WS, and EM at least to form Z. CP then is an operation on the workspace, mapping WS to WS'. What operation? Here the general conditions C [seven desiderata] on operations come into play, yielding the conclusion that the operation is MERGE with Replace, removing elements from WS, knocking out many options and getting back to the original idea of simplest Merge and Replace, but now in a principled way. Thus, the removal of elements from WS isn't stipulated; it is a consequence of C and third-factor economy. And there is no operation Remove.

(3) a. birds that fly instinctively swim

b. instinctively, birds that fly swim

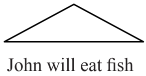
(4) Hierarchical Structures

a. b. c.

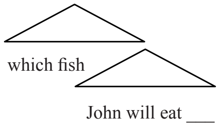


(5) Phrase Structure Grammar and Transformation

a.



b.



(6) Merge works in accord with third factor considerations such as the following two structure-preserving principles:

a. the condition of inclusiveness: Do not add any new properties to α and β in the process of Merge (α, β), and

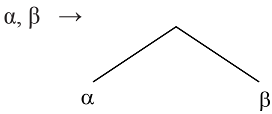
b. the no-tampering condition: Do not take away any existing properties from α and β in the process of Merge (α, β).

(7) Given (6a-b), Merge (α, β) puts α and β into a set, forming a two-membered set consisting of α and β,

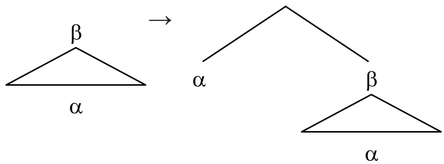
Merge (α, β) = {α, β}.

(8) Unless stipulated, External Merge (EM) and Internal Merge (IM) also follow:

a. EM, when α and β are distinct



b. IM, when α is part of β



(9) Does this formulation of Merge make sense?

To form {XP, YP} (e.g. NP-VP), Merge must be able to construct syntactic objects SOs in parallel (meaning independently), and bring them together somewhere.

a. The man likes the dog.

b. [$_{DP}$ the man] + [$_{VP}$ likes the dog]

This presupposes that there is a workspace, in which operations such as Merge are being carried out.

(10) But then what is the workspace WS?

This question hasn't been properly answered, and fixing it does have consequences. Chomsky revises Merge to MERGE, an operation on WS, not particular SO, and takes WS to be the stage of the derivation at any given point. This revision raises all sorts of questions, and Chomsky et al. (2017) explore some of those questions and identify their implications.

(11) How was Merge defined back in 1995?

Chomsky (1995:226) says: "The simplest such operation takes a pair of syntactic objects (SO_i, SO_j) and replace them by a new combined syntactic object SO_{ij}. Call this operation Merge." So, Merge forms SO_{ij}, and remove SO_i and SO_j, but where does Merge remove SO_i and SO_j from? We now have an answer: Merge forms SO_{ij} and remove SO_i and SO_j from WS (a set of SOs).

(12) The simplest and most general way to proceed is to change the concept Merge to a slightly different one: an operation on WS = [SO_i, SO_j] that doesn't just form SO_{ij} = {SO_i, SO_j} but removes SO_i and SO_j from WS, yielding WS' = [SO_{ij}] (where [ ] is used for the WS set, while { } is used for the SO set).

(13) MERGE (WS) = WS'

a. WS = [SO_i, SO_j]

b. WS' = [SO_{ij}]

(14) The faculty of language crucially involves recursion, a universal property of human language. The basic idea of recursion is that any already generated object is accessible to further operations; under SMT, we formulate recursion in a way

we stipulate no specific property, putting no extra condition on it; recursion ought to be free. Thus, general recursion with no stipulation allows SO, generated in WS, to be accessible to further operation.

II. A Research Project

(15) Background of the project (Seely 2018)

[…] we trace the "maximize minimal merge" program of Epstein, Kitahara, and Seely (among others): The idea is to maximize the effects of Merge, while minimizing its form—posit internal to the Narrow Syntax (NS) as little as possible beyond simplest Merge, striving ultimately for the thesis "Interfaces + Recursion = Language," as initially articulated in Chomsky 2007. Merge is the fundamental operation of the NS.

[…] Since Chomsky (2004, Beyond Explanatory Adequacy), Merge is argued to apply 'freely;' it is not applying for any 'purpose'—for feature checking and the like. Nor does it stop applying for any reason, such as the mover's needs being fulfilled (Epstein 1992, Rizzi 2010). Rather, it applies, or fails to, for no other reason than its application is always entirely optional. But, does this mean that any two syntactic objects can be merged, regardless of whether they are contained in the same larger object? Recent research suggests that the answer is: yes. We find not only classic External and Internal Merge, but also Parallel, Sidewards, and 'double peak'-creating Merge.

In recent lectures, however, Chomsky subjects Merge to further minimalist scrutiny, seeking to "[…] formulate general principles that any operation of language ought to meet." The goal is to "[…] construct a general framework that accommodates a wide range of alternatives, including extensions of Merge in the literature, and in fact others that might be possibilities, and then ask what *survives close analysis in terms of reasonable conditions that are desiderata for generative procedures."*

What survives is classic Merge. The rest – Parallel, Sidewards, Double-peak-creating – are all fatally problematic. Crucially, this is not stipulated, rather it follows as a consequence of natural (optimally, 3rd factor) conditions.

(16) Revising Merge to MERGE (Chomsky, personal communication)

For me at least this project arose because of a recognition that (i) the narrow version of Merge we were using is wrong, and (ii) it was so imprecisely formulated that many other uses were current, and were understood (by our friends) to be just special cases of Merge: Late Merge, Parallel Merge, Sidewards Merge, etc.

I therefore suggested what seems to me a more principled approach to the whole question, as in A-E:

(A) Consider the broadest possible range of Merge-based computational operations, including all the "extended" versions that have been suggested: The broad definition of Merge should accommodate these.
(B) Formulate plausible conditions C that should hold of legitimate operations.
(C) Under C, test the range of possibilities that fall under (A) and show that all the "extended" versions are barred and only EM, IM in pretty much the familiar sense (with some sharpening) pass through the filters.
(D) Formulate a narrow version of Merge that accommodates just EM, IM and excludes the "extended" versions.
(E) If possible, prove that the narrow version is literally deducible from C and third factor.

There is a single overall research enterprise. As in any such enterprise, there is *a logical order and a research order, and they are not the same. The logical order is A to E. The research order might be "first try to clarify D," then explore some cases of B, etc. The question [whether] A and D are parallel enterprises doesn't arise.*

So accept (A) – (E), making it clear that [D] differs from the others in that it is not a new step but rather the conclusion from (B) and (C).

(17) Formulating MERGE (Chomsky, personal communication)

Keep term-of in the old sense, non-reflexive (where X is a term of Y iff $X \neq Y$, $X \in Y$, *or* $X \in Z$, *Z a term of Y). Introducing minimality eliminates the need for the biconditional. Then the broad version under (A) is (I):*

(I) MERGE(P, Q, WS) = [{P, Q}, $X_1, \ldots, X_n$ *] = WS', where if Y is a term of WS, it is a term of WS'.*

Running through (B), (C) we conclude (II), under (D):

(II) for any <u>accessible</u> terms P, Q in WS,
MERGE(P, Q, WS) = [{P, Q}, $X_1, \ldots, X_n$*] = WS', where*
(i) $Y \in WS$ *and* $Y \neq P, Q \rightarrow Y \in \{ X_1, \ldots, X_n \}$
(ii) <u>accessible</u> terms appear only once in WS'
(iii) $\{ X_1, \ldots, X_n \}$ *minimal*
"minimal" means n minimal and each X_i *minimal*

This amounts to saying that Merge must be well-defined, as a function with a determinate output.

[(II) is] (s)atisfied by EM, IM. But others (Keep, Parallel, others) can't satisfy

both (II-i) and (II-ii). Their distinctive property is that accessible terms appear more than once in WS'.

Allow an element of LEX to enter WS, dropping the option of merging from LEX.

(18) WS = [a, b, c] (where P = a, Q = b, Y = c)

MERGE (a, b, WS) =

WS' = [{a, b}, c]

(19) We need to clarify all the relevant notions assumed in this formulation of MERGE.

a. What distinguishes accessible terms from inaccessible ones? Does the PIC play any role?

b. How do LIs enter into WS?

c. How do copies formed by IM evade a violation of (II-ii)?

III. How Does MERGE Operate?

(17) (II) for any accessible terms P, Q in WS,

MERGE (P, Q, WS) = [{P, Q}, X_1, ..., X_n] = WS', where

(i) $Y \in$ WS and $Y \neq P, Q \rightarrow Y \in \{ X_1, ..., X_n \}$

(ii) accessible terms appear only once in WS'

(iii) $\{ X_1, ..., X_n \}$ minimal

(20) What MERGE does is the mapping of WS to WS'.

In this sense, MERGE is working on WS. What is happening internal to each mapping is articulated in (II), but what is crucial is that MERGE modifies WS. Unless stipulated, there is one and only one WS at any stage of the derivation, and it proceeds by "updating" WS step by step.

(21) There are two ways to "update" WS:

a. LEX maps WS to WS' by adding LIs to WS, and

b. MERGE maps WS to WS' by operating on WS, as defined in (II).

(22) Copy vs. Repetition (Chomsky, personal communication)

Merge always leaves copies, but they only surface with IM because Merge (understood as Replace) eliminates the EM copy. That is, Merge(X,Y) leaves two copies, the original X and Y. Under EM(X,Y), both copies disappear under Replace. Under IM(X,Y), Y a term of X, X disappears under Replace but Y remains.

(23) EM

(i) WS = [{a, {b, c}}, d, e]

(ii) Let P = {a, {b, c}}, Q = d

(iii) $\{X_1, \ldots, X_n\}$ = {e}

(iv) WS' = [{d, {a, {b, c}}}, e]

(24) IM

(i) WS = [{a, {b, c}}, d, e]

(ii) Let P = {a, {b, c}}, Q = c

(iii) $\{X_1, \ldots, X_n\}$ = {d, e}

(iv) WS' = [{c, {a, {b, c}}}, d, e]

(25) MERGE is a symmetric operation; there is absolutely no room for asymmetry concerning P and Q.

(26) Recall that copy theory need not be stipulated as a linguistic device. NTC belongs to third factor. Merge (X, Y), placed in the third factor environment, has no choice but leaves X and Y intact. Similarly, the ban on more than one accessible terms need not be stipulated as a linguistic constraint. Determinacy belongs to third factor. MERGE (P, Q, WS), placed in the third factor environment, has no choice but keeps accessible copies to one and only one.

(27) MERGE's potential capacity as machinery can carry out Parallel Merge (PM), Sidewards Merge (SM), Late Merge (LM), and other "extended" versions of

Merge, but they do not surface. Why? Because MERGE works in a way permitted under third factor principle. So, it is not like MERGE carries out PM, and Determinacy forces MERGE to halt right there. Rather, MERGE, placed in the third factor environment, has no choice but works in accord with Determinacy, hence, PM, SM, LM, and other "extended" versions of Merge do not show up. Their absence is a consequence of MERGE + third factor Determinacy, conforming to SMT.

(28) Visibility vs. Accessibility

Search finds every term in WS. We say every term in WS is visible.

(29) Phase Impenetrability Condition (PIC) (Chomsky 2000:108)

In phase P with head α, the domain of H is not accessible to operations outside α, and only H and its edge are accessible to such operations.

Thus, given PIC, as a phase completes, its phase-head-complement becomes inaccessible to MERGE (see also Goto and Ishii 2018 for the relevant discussion).

(30) Shortest Move Corollary (SMC) (as a subpart of Minimal Search, suggested by Chomsky, personal communication)

Given two options, the shorter "move" prevails; for example, $[Y_1 [...[...Y_1 ...]...]]$*, 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.*

(31) 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.

(32) 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, 2015) 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.

(33) Note that the extension condition and the proper binding condition are dispensable, while their desirable aspects just follow. See also Epstein, Kitahara, and Seely 2018 for the relevant discussion concerning remnant movement asymmetries.

(34) Given (28), (29) and (30), all terms in WS are visible, but not all terms in WS are accessible.

IV. Six Sample Derivations: Only EM and IM Surface, All Other "Extended" Versions Do Not

(17) (II) for any <u>accessible</u> terms P, Q in WS,

MERGE (P, Q, WS) = [{P, Q}, X_1, ..., X_n] = WS', where

(i) $Y \in WS$ and $Y \neq P, Q \rightarrow Y \in \{ X_1, ..., X_n \}$

(ii) <u>accessible</u> terms appear only once in WS'

(iii) $\{ X_1, ..., X_n \}$ minimal

(27) MERGE's potential capacity as machinery can carry out Parallel Merge (PM), Sidewards Merge (SM), Late Merge (LM), and other "extended" versions of Merge, but they do not surface. Why? Because MERGE works in a way permitted under third factor principle. So, it is not like MERGE carries out PM, and Determinacy forces MERGE to halt right there. Rather, MERGE, placed in the third factor environment, has no choice but works in accord with Determinacy, hence, PM, SM, LM, and other "extended" versions of Merge do not show up. Their absence is a consequence of MERGE + third factor Determinacy, conforming to SMT.

(35) External Merge

WS = [a, b, c] (where P = a, Q = b)

MERGE(a, b, WS) =

WS' = [{a, b}, c]

(36) Internal Merge

WS = [{a, {b, c}}] (where P = c, Q = {a, {b, c}})

MERGE(c, {a, {b, c}}, WS) =

WS' = [{c, {a, {b, c}}}]

two copies of c surface, but under SMC, only one of them is accessible, thereby satisfying Determinacy

(37) Parallel Merge/Late Merge/Sideward Movement

WS=[a, {b, c}] (where P = a, Q = c)

MERGE(a, c, WS) =

WS' = [{a, c}, {b, c}]

two copies of c surface, and both of them are accessible, thereby violating

Determinacy

(38) Countercyclic Merge A (e.g., countercyclic subject raising, LF object shift)

WS = [{a, {b, {c, d}}}] (where P = c, Q = {b, {c, d}})

MERGE(c, {b, {c, d}}, WS) =

WS’ = [{c, {b, {c, d}}}, {a, {b, {c, d}}}]

three copies of c surface, and two of them are accessible, thereby violating Determinacy

|WS| < |WS’|, thereby violating RCR

(39) Countercyclic Merge B (e.g., countercyclic XP-adjunction, head movement)

WS = [{a, {b, {c, d}}}] (where P = a, Q = c)

MERGE(a, c, WS) =

WS’ = [{a, c}, {a, {b, {c, d}}}]

two copies of a and two copies of c surface, and all of them are accessible, thereby violating Determinacy

|WS| < |WS’|, thereby violating RCR

(40) Countercyclic Merge C (e.g., merger of X and Y from two distinct SOs: {X, Z} and {Y, W})

WS = [{a, b}, {c, d}] (where P = a, Q = c)

MERGE(a, c, WS) =

WS’ = [{a, c}, {a, b}, {c, d}]

two copies of a and two copies of c surface, and all of them are accessible, thereby violating Determinacy

|WS| < |WS’|, thereby violating RCR

(41) Notice, the mappings violating RCR also violate determinacy. One way to remove such redundancy is to eliminate RCR, together with the stipulation that lexical insertion is exempt from RCR, and deduce the desirable effects of RCR from the third factor principle of determinacy.

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