Notes on MERGE and Determinacy Principle

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1. Introduction

1. **Purpose**:
- To consider how the MERGE-based system in Chomsky (2017) and Chomsky et al. (2019) can account for the basic properties of discrete infinity and displacement.
- To explore Goto & Ishii (2019)'s analysis in which Determinacy Principle can explain various language phenomena such as Subject Condition, *that*-trace effect, Freezing effects, etc.

2. **Consequences**
- We can explore that Seven Desiderata can open up a new opportunity to account for various linguistic phenomena.
- We can consider future research which is related to MERGE-based system and Seven Desiderata.

2. Theory of MERGE-Based System

(1) MERGE (Chomsky 2017 and Chomsky et al. 2019)

MERGE maps WS = [X, Y] to WS' = [{X, Y}]

(When a WS is updated to a WS', the lexical items that were contained in the WS but not chosen to be merged are all kept in the WS')

a. **Chomsky (2015):** Merge was assumed to take two syntactic objects, e.g. a and b, and simply combine them, which results in a set, {a, b}.

b. **Chomsky (2017) and Chomsky et al. (2019):** However, human language also produces a new structure from two syntactic objects that have already been built independently. In order to construct such XP-YP structures without modifying the internal structure that has already been built in each of them, it is necessary to assume a space, which he calls a *workspace*. **He claims that the merging operation should apply not to individual syntactic objects, but to workspaces.**

(2) Seven Desiderata (Chomsky 2017 and Chomsky et al. 2019)

Chomsky (2017) proposes seven desiderata, to which he claims the application of MERGE must conform.

a. **Descriptive Adequacy**: a guideline to build a syntactic theory
b. **Strong Minimalist Thesis**: the conditions of, e.g. no-tampering, inclusiveness and phase-impenetrability, which belong to the third factor principle
c. **Restrict Computational Resources (RCR)**: MERGE must not expand WSs. This means that syntactic objects/lexical items contained in a WS must not increase after the application of MERGE.
d. **Determinacy (DET)**: accessible terms can appear in a WS only once. This means that more than one copy of the item that is accessible to further merging operations must not be produced by the application of MERGE.
e. **Stability**: the interpretation of a SO (including copies) must not be changed throughout a derivation.
f. **Recursion**: a generated SO must be accessible to further syntactic operations.
g. **Strictly Binary**: only two SOs can be candidates of MERGE.

(3) The Process of External Merge (Hosono 2019)

a. WS = [a, b, c], in which contains three lexical items, a, b and c.
b. MERGE applies to the WS, taking a and b and merging them,
c. WS' = [{a, b}, c], where {a, b} represents the set composed of a and b, and c, which was contained in the WS but not chosen to be merged, is left as it is.
d. WS = [a, b, c] → WS' = [{a, b}, c] **[RCR (OK) / DET (OK)]**
e. The three syntactic objects, i.e. a, b and c, in the original WS are reduced to two syntactic objects, i.e. {a, b} and c, in the updated WS'. This merging operation does not violate RCR.
f. No copies of the same item are produced. Determinacy is not violated either.

(4) The Process of Internal Merge (Hosono 2019)

a. WS = [{a, {b, c}}], in which b and c externally merge, resulting in the set {b, c}, to which a externally merges, resulting in the set {a, {b, c}}.
b, MERGE applies to the WS, taking c and {a, {b, c}} and merging them.
c. WS' = [{c, {a, {b, c}}}]
d. WS = [{a, {b, c}}] → WS' = [{c, {a, {b, c}}}] **[RCR (OK) / DET (OK)]**
e. The number of syntactic objects does not change before and after MERGE applies. The original WS contains one syntactic object, i.e. {a,{b, c}}; the updated WS' too contains one syntactic object, {c,{a,{b, c}}}. This merging operation does not violate RCR.
f. The updated WS' [{c, {a, {b, c}}}] contains two copies of c. Since they would both be accessible to further operations, the application of internal MERGE would

violate Determinacy. But only the higher copy is found by minimal search and is accessible to further merging operations; thus, this case can be legitimate.

(5) Chomsky et al. (2017) and Chomsky (2017) claim that merging operations other than external and internal MERGE are illegitimate. This means that late merge, sideward movement, and parallel merge are illegitimate under the framework of workspace.

(6) The Process of Countercyclic Internal Merge (Kitahara 2017)

a. WS = [{a, {b, {c, d}}}] in which c and d externally merge, resulting in the set {c, d}, to which b externally merges, resulting in the set {b, {c, d}}, and further to which a externally merges, resulting in the set {a {b, {c, d}}},
b, MERGE applies to the WS, taking d and {b, {c, d}} and merging them.
c. WS' = [{d, {b, {c, d}}}, {a, {b, {c, d}}}]
d. WS = [{a, {b, {c, d}}}] → WS' = [{d, {b, {c, d}}}, {a, {b, {c, d}}}] **[RCR (NO) / DET (NO)]**
e. The number of syntactic objects in the original WS increases in the updated WS', i.e. from one syntactic object, {a, {b, {c, d}}}, to two syntactic objects, {d, {b, {c, d}}} and {a, {b, {c, d}}}. This merging operation violates RCR.
f. The updated WS' = [{d, {b, {c, d}}}, {a, {b, {c, d}}}] contains three copies of d. Since they are contained in different syntactic objects, neither of them can be found by minimal search. This merging operation violates Determinacy.

(7) The Process of Parallel MERGE, Late Merge, and sideward movement (Kitahara 2017)

a. WS = [{a, {b, c}}], in which b and c externally merge, resulting in the set {b, c}, to which a externally merges, resulting in the set {a, {b, c}}.
b, MERGE applies to the WS, taking c and a and merging them.
c. WS' = [{a, c}, {b, c}]
d. WS = [{a, {b, c}}] → WS' = [{a, c}, {b, c}] **[RCR (NO) / DET (NO)]**
e. The number of syntactic objects in the original WS increases in the updated WS', i.e. from one syntactic object, {a, {b, c}}, to two syntactic objects, {a, c} and {b, c}. This merging operation violates RCR.
f. The updated WS' = [{a, c}, {b, c}] contains two copies of c. Since they are contained in different syntactic objects, neither of them can be found by minimal search. This merging operation violates Determinacy.

(8) Internal Merge, Determinacy and Economy (Kitahara 2017)

a. WS = [{a, {b, c}}] → WS' = [{c1, {a, {b, c2}}}] **[RCR (OK) / DET (?)]**
b. selection of c1: find a member of {c1, {a, {b, c2}}}
c. selection of c2: find a member of {c1, {a, {b, c2}}}, and find its member

d. Thus, on the **computational efficiency** grounds alone, the higher copy of c is selected over the lower copy of c; as a result, the higher copy of c is one and only one accessible copy of c.

e. In WS' = [{c1, {a, {b, c2}}}], there are two copies of c, and the shortest move corollary selects the higher copy of c.

(9) Remnant Movement, Determinacy and PIC (Kitahara 2017)

a. WS = [{H, {c, {a, {b, c}}}}]

b. MERGE applies to the WS, taking {b, c} and a {H, {c, {a, {b, c}}}} and merging them.

c. WS' = [{{b, c}, {H, {c, {a, {b, c}}}}}] **[RCR (NO) / DET (NO)]**

d. Example 1. (Japanese Scrambling)

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

(ii) [[X ... Y_1 ...]$_2$ [Y1 [... T ... [X ... Y_1 ...]$_2$ ...]]]

e. Example 2. (English wh-movement)

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

(ii) [[X ... Y_1 ...]$_2$ [Y_1 [C ... [X ... Y_1 ...]$_2$ ...]]]

f. **Example 3. (English wh-movement)**

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

(ii) [[X ... Y_1 ...]$_2$ [C [Y_1... [X ... Y_1 ...]$_2$ ...]]]

PIC makes inaccessible the phase-head-complement [$_{PH}$ C Y_1... [X ... Y_1 ...]$_2$ ...]]. Thus, there is only one accessible copy of Y, which is in the phase-edge of the embedded C. Thus, the ambiguous rule-application situation does not arise.

(10) X-adjunction and Determinacy (Kitahara 2017)

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

b. MERGE applies to the WS, taking {a, c} and {a, {b, {c, d}}} and merging them.

c. WS' = [{a, c}, {a, {b, {c, d}}}] **[RCR (NO) / DET (NO)]**

d. The number of syntactic objects in the original WS increases in the updated WS', i.e. from one syntactic object, {a, {b, {c, d}}}, to two syntactic objects, {a, c} and {a, {b, {c, d}}}. This merging operation violates RCR.

e. The updated WS' = [{a, c}, {a, {b, {c, d}}}] contains two copies of a and c. Since they are contained in different syntactic objects, neither of them can be found by minimal search. This merging operation violates Determinacy.

(11) XP-adjunction and Determinacy (Kitahara 2017)

a. WS = [{e, f}, {a, {b, {c, d}}}]

b. MERGE applies to the WS, taking {a, c} and {a, {b, {c, d}}}} and merging them.

c. WS' = [{a, {e, f}}, {a, {b, {c, d}}}] **[RCR (OK) / DET (NO)]**

d. The number of syntactic objects in the original WS is not changed in the updated WS', i.e. in WS, two syntactic objects, {e, f} and {a, {b, {c, d}}}, and in WS' two syntactic objects, {a, {e, f}} and {a, {b, {c, d}}}. This merging operation observes RCR.

e. The updated WS' = [{a, {e, f}}, {a, {b, {c, d}}}] contains two copies of a. Since they are contained in different syntactic objects, neither of them can be found by minimal search. This merging operation violates Determinacy.

(12) Chomsky (2004) vs Chomsky (2017)

a. Adjunction operation adds materials in a separate domain, and they are not accessible. (Chomsky 2004)

b. X-adjunction and XP-adjunction violate Determinacy Principle. (Chomsky 2017)

3. Determinacy Principle and Successive-Cyclic Movement

(13) Ambiguous Rule Application Problem

a. WS =[{**c1**, {a, {b, **c2**}}}] → WS' = [{c, {c1, {a, {b, c2}}}}]

b. We have two options to create WS', i.e., either to move the higher copy of c (=c1) or the lower copy of c (=c2). This ambiguous rule application may violate Determinacy Principle.

(14) Chomsky et al. (2019): Minimal Search Approach

Only the higher copy is found by minimal search and is accessible to further merging operations.

(15) Goto & Ishii (2019): PIC Approach

PIC resolves the problem of an ambiguous rule application induced by multiple applications of MERGE.

- **What**$_i$ did you say that John bought t$_i$?
  - a. [$_{RP}$ **what** [R(BUY) what]]
  - b. [$_{CP}$ **what** [C [$_{TP}$ John [T [$_{vP}$ John [v-R(BUY) [$_{RP}$ what [R(BUY) what]]]]]]]]
  - c. [$_{vP}$ you [v*-R(SAY) [$_{RP}$ **what** [R(SAY) [$_{CP}$ what [C-that [$_{TP}$ John [...
  - d. [$_{CP}$ **what** [C-that [$_{TP}$ you [T [$_{vP}$ you [v-R(SAY) [$_{RP}$ what [R(SAY) [$_{CP}$ what...

☞ Although there are two copies of *what*, i.e. the copy in the Spec of R and the copy in the base position, the copy in the base position, which is within R-complement, is not accessible because of the PIC after the phase-R-complement Transfer.

4. Explanatory Power of Determinacy Principle

(16) Subject Condition and Determinacy Principle (Goto & Ishii 2019)

a. * Who did [pictures of t] please you?

WS= [$_{CP}$ who [C-did [$_{TP}$ [pictures of **who**] [T [*v*P [pictures of **who**] [*v* […

→ **violation of Determinacy**

b. Who is there [a picture of t] on the wall?

WS= [CP who [C-is [TP there [T [$_{vP}$ [a picture of **who**] [*v* […

(17) Freezing Effect and Determinacy Principle (Goto & Ishii 2019)

a. * John seems that reads a book.

WS= [$_{CP}$ John [C-that [$_{TP}$ **John** [T [$_{vP}$ **John** [*v*-R(READ) […

→ **violation of Determinacy**

(18) MOM and Determinacy Principle (Goto & Ishii 2019)

a. * There seems a man to be in the room.

WS=[a man [to [v+R(be) [**a man**[Partitive] [R(be) [**a man**[uCase] in the room]]]]]]

→ **violation of Determinacy**

b. There seems to be a man in the room.

WS=[there [to [v+R(be) [a man[Partitive] [R(be) [**a man**[uCase] in the room]]]]]]

5. Determinacy Principle and *that*-trace effect

(19) *that*-trace Effect and Label-Based System (Chomsky 2013, 2015)

a. ***Who** do you think that **t** loved James?

→ [$_{CP}$ C$_{phasehood}$ [$_{<φ, φ>}$ **DP$_{wh}$** [T [$_{v*P}$ …]]]] : **violation of PIC**

b. **Who** do you think **t** loved James?

→ [$_{CP}$ [$_{<φ, φ>}$ **DP$_{wh}$** [$_{TP}$ TP$_{phasehood}$ [$_{v*P}$ …]]]] :

(20) Problems of Chomsky's (2013, 2015) Analysis

a. Downward phasehood inheritance seems to be a countercyclic operation (Fukuda 2017)

b. Chomsky's (2013, 2015) analysis cannot explain the adverb effect in *that*-trace phenomena. (Fukuda 2017)

(i) *Who* did Leslie say that, for all intents and purposes, *t* was the mayor of the city? (Browning 1996: 250)

c. **Who** do you think **t** loved James?
→ [$_{CP}$ **DP$_{wh}$** [$_{\alpha(?)}$ t$_i$ [$_{TP}$ TP$_{phasehood}$ [$_{v*P}$ ...]]]] : **unlabeled α (?)**

☞ Chomsky (2015:11) assumes that once the label (i.e. <phi, phi>) is determined, it is temporarily stored in the **memory** until Transfer applies to the phase under consideration. Thus, for interpretation at CI, labels are computed at the phase level, with cyclic transfer.

d. *[$_\beta$ **Which dog$_i$** do you wonder [$_\alpha$ **t$_i$** [$_\delta$ C$_Q$ John likes t'$_i$]]]

☞ Chomsky (2015:8) argues that the unnaturalness of (20d) is dues to **semantic anomaly (=gibberish)** rather than syntactic deviation.

☞ Fukuda (2017:4) argues that if it is possible to utilize "memory" in the derivation of (20c), the label <Q, Q> of α in (20d) will be stored there for the CI interpretation. Thus, in order to distinguish (20c) from (20d), it must be assumed that **memory is available in (20c) but not in (20d)**.

(21) *that*-trace Effect and MERGE-Based System (Goto & Ishii 2019)

a. *Who$_i$ do you think that t$_i$ saw Bill?
WS= [$_{CP}$ **who** [C-that [$_{TP}$ <u>who</u> [T [$_{vP}$ <u>who</u> [v-R(SEE) [$_{RP}$ Bill [R(SEE) [...
→ **violation of Determinacy**

b. Who$_i$ do you think t$_i$ saw Bill?
WS=[C(that) → Φ [$_{TP}$ <u>who</u> [T [$_{vP}$ who [v-R(SEE) [...

(22) Skipping Strategy and MERGE-Based System (Goto & Ishii 2019)

a. *What$_i$ do you think that t$_i$ is in the box?

b. What$_i$ do you think that there is t$_i$ in the box? (Rizzi and Shlonsky 2007: 126)
WS=[$_{CP}$ **what** [C-that [$_{TP}$ there [T-is [$_{vP}$ <u>what</u> [v [...

(23) Problems of Goto & Ishii (2019)

a. ***Who$_i$** did John say [that [t$_i$ quickly ran to the store]]?
WS=*[$_{CP}$ **who** [C-that [$_{TP}$ <u>who</u> [quickly [T [$_{vP}$ <u>who</u> [*v* [...
→ **violation of Determinacy**

b. **Who$_i$** did John say [that [fortunately t$_i$ ran to the store]]?
WS=[$_{CP}$ **who** [C-that [$_{TP}$ <u>who</u> [fortunately [T [$_{vP}$ <u>who</u> [*v* [...
→ **(23b) causes the violation of Determinacy but it is grammatical.**

5. Conclusion

We have explored that Seven Desiderata can open up a new opportunity to account for various linguistic phenomena.

6 References

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