Where Does Determinacy Apply?

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Abstract

Chomsky et al. (2019) propose that Determinacy applies at the *output* of MERGE, while Goto and Ishii (2020a, b, c) propose that it applies at the *input* of MERGE. Given that Determinacy belongs to a third factor, and Search procedure is involved before MERGE to determine its input, or an INT(erpretation) process is participated after MERGE for proper interpretation of copies generated, there are at least two other approaches that can be considered: *Determinacy at Search* and *Determinacy at INT*. In this paper, we try to consider how these approaches can be implemented without losing the insights obtained in the studies of Input/Output Determinacy at MERGE.

1. Output Determinacy at MERGE

Let us first review Chomsky et al.'s (2019) approach to Determinacy. They clarify the concept workspace WS and reformulate Merge as MERGE as an operation on WS, not particular syntactic object SO (see Chomsky in press for a more elaborated definition of MERGE, which, however, does not affect the following discussion):

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

They argue that MERGE should apply in a deterministic fashion based on the principle of Determinacy (2), which bans ambiguous rule applications:

(2) If the structural condition for a rule holds for some workspace, then the structural change must be unique (Chomsky 2019: 275).

They also assume that everything in WS is accessible based on the notion of recursion as stated in (3):

(3) Any SO generated in WS remains accessible to further operations.

Thus, in (4), *a, b, c, d, {c, d}, {b, {c, d}}* and *{a, {b, {c, d}}}* are all accessible to further operations including MERGE:

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

They claim that Determinacy requires *subsequent* rules to apply in a deterministic fashion, ensuring that WS should be kept minimal throughout a derivation:

(5) Determinacy applies at the *output* of MERGE.

According to (5), which we will call *Output Determinacy at MERGE*, a Determinacy violation occurs if MERGE creates WS that poses an ambiguous rule application problem for the *subsequent* derivation. To see more precisely, let us consider (6) where MERGE takes WS_1 as its input and maps it to WS_2 by applying IM to *c*:

(6) a. WS_1 = [{a, {b, <u>c</u>}}, d]
b. WS_2 = [{**c**, {a, {b, <u>c</u>}}}, d]

Under (3), every SO in (6) is accessible to MERGE. Under (5), Determinacy applies at the *output* of MERGE, *i.e.* at WS_2. In WS_2, there are two copies of *c*: <u>c</u> in {b, <u>c</u>} and **c** in {**c**, {a, {b, <u>c</u>}}. This poses an ambiguous rule application problem. If IM applies to *c* in the *subsequent* derivation, there is no unique way to apply IM to *c* due to its two copies. Hence, (6) is a Determinacy violation. If this is the case, it follows that no (successive-cyclic) IM is ever allowed. This is clearly an undesirable result. One possible way out of this problem is a way to appeal to Minimal Search (MS), according to which a shorter move selected by MS wins given two options (Chomsky in press). In (6b), there are two copies of *c*, but MS selects only the higher copy of *c*, *i.e.* **c**, so there is no Determinacy violation. This approach seems to be plausible given that MS is a third factor that can be used when needed (Chomsky in press). But we may want to point out two concerns for the MS-approach. First, as shown below, even if we do not appeal to MS, the ambiguous rule application problem can be resolved by an independently motivated condition on Transfer, *i.e.* the Phase Impenetrability Condition (PIC). Also, regarding accessibility, there seems to be a redundancy between MS and PIC: that is, MS makes the effects of PIC vacuous when we decide whether or not an element is accessible. If a theory with no redundancy is favorable (Chomsky 1995: 152), it will be worthwhile to pursuit the theory that accessibility is restricted only by PIC (for another concern for the MS-approach, see Section 3.1).

2. Input Determinacy at MERGE

Goto and Ishii (2020a, b, c) seek for the possibility of such a theory by claiming that Determinacy apply at the *input* of MERGE, according to which a Determinacy violation occurs if there is an ambiguous rule application at the *present* stage of a derivation (not at a *subsequent* stage).

(7) Determinacy applies at the *input* of MERGE.

Under (7), let us reconsider (6):

(8)(=(6)) a. $WS_1 = [\{a, \{b, \underline{c}\}\}, d]$
b. $WS_2 = [\{\mathbf{c}, \{a, \{b, \underline{c}\}\}\}, d]$

According to (7), which we will call *Input Determinacy at MERGE*, Determinacy applies at the *input* of MERGE, *i.e.* at WS_1. In WS_1, there is only one copy of *c*, so there is only one option to create WS_2: to move $\underline{c}$ in the base position. This is not an ambiguous rule application. Hence, there is no Determinacy violation in (8). Suppose further that MERGE takes WS_2 as its input and then maps it to WS_3, *i.e.,* IM applies to *c* again:

(9) a. $WS_2 = [\{\mathbf{c}, \{a, \{b, \underline{c}\}\}\}, d]$
b. $WS_3 = [\{\mathbf{c}, \{\underline{c}, \{a, \{b, \underline{c}\}\}\}\}, d]$

In (9a) WS_2, there are two copies of *c* at the input of MERGE: **c** and $\underline{c}$.

There are two options to create WS_3, *i.e.,* either to move **c** or to move c. This ambiguous application violates (7). Hence, there is a Determinacy violation in WS_3. Note that in WS_3, a Determinacy violation does not occur unless IM applies to *c* in WS_2.

Taking (10), let us consider how successive-cyclic IM is ensured under Input Determinacy without recourse to MS, a notion that plays an important role in Output Determinacy (the gray indicates PIC domain):

(10) **What** did you say that John bought ***t***?

a. [$_{RP}$ **what** [R(buy) what]]

b. [$_{CP}$ **what** [C [$_{TP}$ John [T [$_{vP}$ John [*v* [$_{RP}$ what [R what]]]]]]]]

c. [$_{vP}$ you [*v* [$_{RP}$ **what** [R(say) [$_{CP}$ what [C-that [$_{TP}$ John [… [$_{RP}$ what

d. [$_{CP}$ **what** [C(that) [$_{TP}$ you [T [$_{vP}$ you [*v* [$_{RP}$ what [R [$_{CP}$ what […

In (10a) *what* has raised from its base position to SPEC-R (Chomsky 2013, 2015) and moved to the embedded SPEC-C in (10b). At this stage, *what* has created two copies in the base position and in SPEC-R. However, as in (10b), Transfer applies to R-complement on PIC, (Chomsky 2013, 2015), so *what* in R-complement is inaccessible, only *what* in SPEC-R accessible. Hence no Determinacy violation occurs in (10b). Likewise in (10c), *what* has moved to the matrix SPEC-R. In this case, *what* has created two copies in the embedded SPEC-R and in the embedded SPEC-C. However, Transfer applies to C-complement on PIC, so *what* in the embedded SPEC-R is inaccessible, only *what* in the embedded SPEC-C accessible. Hence no Determinacy violation occurs in (10c), either. The PIC avoids Determinacy violations in (10d) likewise. In this way, successive-cyclic IM is ensured under Input Determinacy without recourse to MS.

Before we consider other possible approaches to Determinacy, let us see some of the immediate empirical consequences of Input Determinacy, as the insight obtained there provide an important viewpoint to the others. Input Determinacy derives the subject island effect such as (11) (Chomsky 1973, Huang 1982). The derivation of (11) is (12):

(11) ***Who** did [pictures of ***t***] please you?

(12) [$_{CP}$ **who** [C-did [$_{TP}$ [pictures of <u>who</u>] [T [$_{vP}$ [pictures of <u>who</u>] [*v* […

In (12), in moving *who* to SPEC-C, there are two accessible copies of *who* in SPEC-T and in SPEC-*v*, hence a Determinacy violation occurs. When *there* occupies SPEC-T, the effect is canceled as in (13) (Lasnik and Park 2003 and Stepanov 2007). This fact can be easily captured as in (14):

(13) **Who** is there [a picture of ***t***] on the wall?

(14) [$_{CP}$ **who** [C-is [$_{TP}$ there [T [$_{vP}$ [a picture of <u>who</u>] [*v* […

In (14), in moving *who* to SPEC-C, there is only one accessible copy of *who* in SPEC-*v*, hence a Determinacy violation does not occur. Extraction from an object is allowed as in (15). Our analysis can correctly capture this, too. See (16):

(15) **Who** did you see [a picture of ***t***]?

(16) [$_{CP}$ **who** [C(did) [$_{TP}$ you … [*v*-R [$_{RP}$ […<u>who</u>] [R(see) […<u>who</u>]]]]]]]

In (16), R-complement Transfer on PIC makes only *who* in SPEC-R accessible. Accordingly, in moving *who* to SPEC-C, there is only one accessible copy of *who* in SPEC-R, inducing no Determinacy violation.

Input Determinacy can also account for the fact that Japanese does not show the subject island effect (Kayne 1983, Lasnik and Saito 1992, Ishii 1997, 2011, Saito and Fukui 1998). Consider (17), where *dare-ni* is scrambled out of the subject phrase:

(17) ?**Dare-ni** [John-ga [[Mary-ga ***t*** atta] koto]-ga
who-dat John-nom Mary-nom met fact-nom
mondai-da to] omotteru] no
problem-is that think Q
Lit. 'Who, John thinks that [the fact that Mary met *t*] is a problem.'

If subjects in Japanese stay in SPEC-*v* throughout a derivation (Fukui

1986 and Kuroda 1988), (17) is analyzed as in (18):

(18) [$_{\text{CP}}$ **dare-ni** [C [$_{\text{TP}}$ T [$_{v\text{P}}$ [Mary-ga dare-ni atta koto]-ga [*v* […

In (18), in moving *dare-ni* to SPEC-C, there is only one accessible copy of *who* in SPEC-*v*, hence a Determinacy violation does not occur. In Spanish, the subject island effect emerges when the subject appears before verb (S-V), but canceled when it appears after verb (V-S). If we follow Uriagereka (1988) and Gallego (2007) in assuming that S in S-V appears in SPEC-T, whereas S in V-S stays in SPEC-*v*, this fact can also be explained under Input Determinacy. In the V-S case, accessible copy appears only in SPEC-*v*, as in (18), so a Determinacy violation does not occur. However, in the S-V case, accessible copies appear both in SPEC-T and in SPEC-*v*, as in (12), hence a Determinacy violation occurs.

The contrast between (19a, b) (Lasnik and Saito 1992) is also within the expectation of Input Determinacy:

(19) a. ***John**, ***t*** came yesterday.
b. **Mary**, John likes ***t***.

Assuming that a topicalized phrase targets SPEC-C (Chomsky 1977, Rizzi 1997, Hiraiwa 2010, Grohmann 2011), the derivations of (19a, b) are represented as in (20a, b) (the analysis can hold even if we assume that a topicalized phrase targets SPEC-T; see Lasnik and Saito 1992 and Bošković 1997):

(20) a. [$_{\text{CP}}$ **John** [C [$_{\text{TP}}$ John [T [$_{v\text{P}}$ John […]]]]]
b. [$_{\text{CP}}$ **Mary** [C [$_{\text{TP}}$ John [T [$_{v\text{P}}$ John [*v*-R [$_{\text{RP}}$ Mary [R Mary]]]]]]]]

In (20a), in moving *John* to SPEC-C, there are two accessible copies of *John* in SPEC-T and in SPEC-*v*, hence a Determinacy violation occurs. On the other hand, in (20b), in moving *Mary* to SPEC-C, such an ambiguous rule application problem does not arise thanks to PIC: after the R-complement Transfer on PIC, only the copy of *Mary* in SPEC-R becomes accessible. See Goto and Ishii (2020c) for a more detailed discussion on Input Determinacy approach to Anti-Locality effects (Saito and Murasugi 1999; Bošković 1994, 1997; Abels 2003; Grohmann 2003).

That-trace effects as in (21) (Kayne 1983; Lasnik and Saito 1992, Chomsky 1986, Rizzi 1990, Ishii 2004, Mizuguchi 2008, Abe 2015, Bosković 2016, among many others) can also receive an Input Determinacy account:

(21) a. ***Who** do you think that ***t*** saw Bill?
     b. **Who** do you think ***t*** saw Bill?

The derivations of (21a, b) are represented in (22a, b):

(22) a. [$_{\text{CP}}$ **who** [C(that) [$_{\text{TP}}$ <u>who</u> [T [$_{v\text{P}}$ <u>who</u> [*v*-R [$_{\text{RP}}$ Bill [R(see) [...
     b. [$_{\text{RP}}$ **who** [R [C(that) → Ø [$_{\text{TP}}$ <u>who</u> [T [$_{v\text{P}}$ <u>who</u> [*v*-R(see) [...

In (22a), in moving *who* to SPEC-C, there are two accessible copies of *who* in SPEC-T and in SPEC-*v*, hence a Determinacy violation occurs. On the other hand, in (22b), in moving *who* to SPEC-R, there is only one copy of *who* in SPEC-T thanks to T-complement Transfer on PIC, hence a Determinacy violation does not occur. See Chomsky (2015) for the assumption that when C(*that*) is deleted, T inherits phasehood from C, and T-complement undergoes Transfer.

As shown in (23), Japanese does not exhibit the *that*-trace effect (Ishii 2004):

(23) [***OP*** [John-ga [***t*** Mary-ni hanasikaketa to] omotteiru yorimo]
     John-nom Mary-dat talked to that think than
     harukani ookuno hito-ga Susy-ni hanasi tagatte ita
     far more people-nom Susy-dat wanted to talk
     'Far more people wanted to talk with Susy than John thinks that talked to Mary.'

As assumed above, given that subjects in Japanese stay in SPEC-*v* throughout a derivation, (23) is analyzed as in (24):

(24) [$_{\text{CP}}$ ***OP*** [$_{\text{TP}}$ [$_{v\text{P}}$ *OP* [$_{\text{RP}}$ Mary-ni R] *v*-R(hanasikake)] T-ta] C-to]

In (24), in moving *OP* to SPEC-C, there is only one accessible copy of *OP* in SPEC-*v*, hence a Determinacy violation does not occur. Italian does not show the *that*-trace effect, either (Perlmutter 1971, Rizzi 1982, 1990, Uriagereka 1988), but this fact can be captured, too, given that in Italian *pro* (Rizzi 1982, 1990) or a verb with rich agreement (Goto 2017) can satisfy EPP or phi-phi labeling by occupying SPEC-T. Under this assumption, in moving a *wh*-phrase to SPEC-C, accessible copy of *wh* only appears in SPEC-*v*, as in (24), so a Determinacy violation does not arise.

Input Determinacy can also subsume the following paradigm (Rizzi and Shlonsky 2007):

(25) a. ***What** do you think that ***t*** is in the box?
b. **What** do you think that there is ***t*** in the box?

(26)	a.	***Quelle**	**étudiante**	crois-tu	que	***t***	va	partir?
		which	student	believe-you	that		go	leave
	b.	**Quelle**	**étudiante**	crois-tu	qui	***t***	va	partir?
		which	student	believe-you	that		go	leave

These show that the *that*-trace effect is canceled when elements such as *there* and *qui* occupy SPEC-T (Kayne 1976, 1983, Rizzi 1990, Rizzi and Shlonsky 2007). The derivations of (26a, b) are represented in (27a, b). In (27b), following Taraldsen (2001) and Rizzi and Shlonsky (2007), we assume that *-i* of *qui* is an expletive-like element occupying SPEC-T:

(27) a. [$_{\text{CP}}$ **what** [C-that [$_{\text{TP}}$ there [T-is [$_{v\text{P}}$ what [*v* [...
b. [$_{\text{CP}}$ **quelle étudiante** [C-que [$_{\text{TP}}$ i [T [$_{v\text{P}}$ quelle étudiante [*v* [...

In both derivations, in moving the *wh*-phrase to SPEC-C, there is only one accessible copy in SPEC-*v*, hence a Determinacy violation does not occur.

In this way, Input Determinacy can have a lot of substantial empirical consequences. For more, see Goto and Ishii (2020c).

3. Other Two Approaches

Above we have introduced two approaches to Determinacy: Output Determinacy at MERGE (Chomsky et al. 2019) and Input Determinacy at MERGE (Goto and Ishii 2020a, b, c). However, given that Determinacy belongs to a third factor principle (Epstein et al. 2018), and Search procedure is involved before MERGE to determine its input (Kato et al. 2014, Goto 2016, Goto and Ishii 2021, Chomsky in press), or an INT(erpretation) process is participated after MERGE for proper interpretation of copies generated (Chomsky in press, Goto and Ishii in prep.), there is no inevitable reason to consider the application of Determinacy only around MERGE, and there are at least two other approaches that can be considered: Determinacy at Search and Determinacy at INT. In this section, we try to consider how these approaches can be implemented without losing the insights obtained in the studies of Input/Output Determinacy at MERGE.

3.1 Determinacy at Search

One possible approach is what we may call *Determinacy at Search*. This approach may be more precise than just claiming that Determinacy applies at the input of MERGE or at the output of MERGE, given that MEREG requires Search to determine its input *n* (see Kato et al 2014, Goto 2016, Goto and Ishii 2021, Chomsky in press for arguments that Search is involved before MERGE). In fact, Goto (2016: 342) claims that "Merge requires search to optimize its application in conformity to n=2." Furthermore, noticing that MERGE that yields order-free two-membered sets is just a special case of FORMSET that yields order-free multi-membered sets, Goto and Ishii (2021) suggest that the difference between the two is whether Search that determines the input operates under the binary restriction when accessing WS to select items (see Goto and Ishii 2021 for a more detailed discussion on the structure-building operations, including Pair-Merge and FORMSEQUENCE). Given this relation between Search and MERGE and the important consequence of Input/Output Determinacy at MERGE that a Determinacy violation arises when there are *two* identical copies of an element in WS, it may be possible to reinterpret Determinacy as follows in terms of Search:

(28) Determinacy is a binary condition that applies to Search that determines the input/output of MERGE.

Let us consider how this notion of Determinacy can capture the subject island effect:

(29) ***Who** did [pictures of ***t***] please you?

To derive (29), suppose we have WS in (30):

(30) WS = [{**C**, {… $\mathbf{who_2}$, {T, {… $\mathbf{who_1}$, {*v*, …}}}}}]

Given (30), how will further derivation proceed? First, to get the correct derivation, MERGE requires Search to determine the input of (C, who). Let's assume that Search can access all elements in WS, unless they are made inaccessible by PIC, as revealed in the study of Input Determinacy. Then, when Search is applied to (30), it becomes possible for Search to access three *relevant* elements: C, who_2 in SPEC-T, and who_1 in SPEC-*v*. If the binary condition is applied to Search as described in (32), then Search(C, who_2, who_1) will violate this condition. Therefore, (33) is taken to be bad because Search cannot provide the appropriate input to MERGE.

Notice that this analysis indicates that Search to determine the input for IM by accessing WS, which we will call *IM-Search for WS*, does not obey the concept of Minimal Search (MS), bringing a new perspective to the relationship between the two. Chomsky (in press) assumes that IM-Search for WS obeys MS, but Search to determine the input of EM by accessing Lexicon, which we will call *EM-Search for Lex*, does not: "For I-language, it seems that the only step beyond this is "search everything": EM in the case of Merge." However, if the above analysis is correct, there is no need to have such a distinction: that is, whether it is EM-Search for Lex or IM-Search for WS, Search to determines the *input* of MERGE can essentially "see" and access all elements and have equal access to them. Note that the binary condition stated in (32) is a condition that is applied just when Search selects two elements, and does not restrict the access itself. That is, Search *before* MERGE is free from MS (NB: this does not avoid the possibility that Search *after* MERGE may still be affected by MS, to which we return below. Also, whether the notion of Search is concerned with processes other than MERGE, such as LABELING or AGREE, is another matter).

What consequences come from this MS-free-approach? A theoretical consequence would be that the arbitrary use of MS can be eliminated. In Chomsky (in press) it is stated that "It is fair to take Σ [=MS] to be a third factor element, on the shelf and available for any operation." If MS is a third factor and is always available, then it should also in principle be possible for EM to obey MS. Chomsky assumes that EM has nothing to do with MS, but what is it that a principled reason why EM does not obey MS? The notion of MS has long been assumed in the minimalist literature and seems to be conceptually and empirically compelling, but the actual cases involving it are limited to IM. Without a principled explanation of why this is so, that is, why only IM obeys MS, or why only EM does not, it raises the suspicion that it may simply be an arbitrary use of MS. Insofar as EM and IM are unified as simply two instantiations of the single rule MERGE, under the always available notion of MS, such asymmetrical aspect should be explicitly explained. On the other hand, if both EM-Search for Lex and IM-Search for WS are just a MS-free "search everything" process, then the arbitrariness problem does not arise to begin with, and more importantly, we could hold EM and IM uniformly and equally for the third factor. The empirical consequence of the MS-free-approach is that the phenomena captured in Input Determinacy can be taken over as they are. In (28), since the insights obtained in the study of Input Determinacy are directly applied to Search, we can inherit the empirical analyses developed there as they are.

That said, Chomsky (in press) still emphasizes that minimality of search should be maintained, by analyzing the example in (31) as follows: "Raising of who_2 yields an ECP violation. If minimality of search is abandoned, nothing bars raising of who_1, which is otherwise a legitimate operation, yielding (6)[=(31)]" (the strike-through lines remain the same as in the original):

(31) *who_3 do you wonder if ~~who_2~~ was appointed ~~who_1~~

However, even if we do not assume minimality as such, we can explain examples such as (31) in terms of (28), considering that passivized *v*Ps are exempt from PIC. Let us consider WS in (32) that derives (31), where no Transfer on PIC applies:

(32) WS = [{**C**, {**who2**, {T, {*v*, {R, **who**$_1$}}}}}]

Here, in applying Search to determine the input of IM(C, who), there are three *relevant* elements that are visible to Search: C, who$_2$ in SPEC-T, who$_1$ in R-complement. Under (28), since the binary condition is applied to Search, Search(C, who$_2$, who$_1$) comes to violate the condition. Therefore, Search cannot provide the appropriate input to MERGE, (31) taken to be bad.

Above we have been developing the argument that MS does not affect Search to determine the *input* of MERGE, but this does not exclude the possibility that MS may still affect the *output* of MERGE. In fact, by appealing to MS, Chomsky (in press) eliminates extensions of Merge such as parallel, multidimensional, sidewards, late Merge: "The operations all add more than one new element, and unlike IM, no copies are protected by MS." What is noteworthy in this MS-based analysis is that MS plays an important role in the *output* of MERGE, not in the *input* of MERGE. That is, MS here affects the *output* in order to satisfy the condition called *Resource Restriction* or *Minimal Yield*, *i.e.* the *output* condition that "only one new accessible element is added." Thus, if this analysis and the above discussion are on the right track, we can obtain the following generalization with respect to the involvement of MS with Search and MERGE:

(33) MS is not involved in Search to determine the *input* of MERGE, but it affects the *output* of MERGE.

Note that this generalization also encounters the problem of the arbitrary use of MS: that is, even though MS is always available, why is it that MS is involved only in the *output* of MERGE, not in the *input* of MERGE? Or, to put (33) differently, it seems to suggest that MS affects only MERGE, but not Search. Where does this asymmetric property of input/output or Search/MERGE come from? This seems to be an important issue for a minimalist inquiry, but we will leave it for future research.

3.2 Determinacy at INT

The other possible approach is what we may call *Determinacy at INT*. Considering that Determinacy is the third factor element available at any time, and that the language system has a representational level INT where copies generated by MERGE receive interpretation, this possibility can also be plausible. In fact, Chomsky (in press) proposes that a rule FORMCOPY (FC) applies at INT to assign a copy relation to elements generated by MERGE, which operates in a way to satisfy Theta Theory that demands that a single theta assigner cannot assign two theta roles to the same element (under the principle of univocality). How FC is applied in practice is one of the key issues currently being explored in several studies (see, for example, Goto and Ishii 2021 in prep. Hayashi 2021, Munakata 2021, Nakashima 2021. In these studies, questions like the following are considered: does FC follow MS, does FC follow PIC, are there any other constraints that limit the application of FC, etc.?). Importantly, the hidden assumption implicitly adopted in these studies, including the original one by Chomsky (in press), is that the copy relation formed by FC must always be a *binary* relation such as $<X_i, Y_i>$ (where *i* indicates identity):

(34) FC applies to *two* structurally identical elements.

Of course, the question of why that must be so remains, but if (34) is on the right track and if we focus on the fact that it must in principle be two, we may be able to rephrase Determinacy in terms of FC at INT as follows:

(35) Determinacy is a binary condition that applies to FC at INT that assigns a copy relation to certain identical elements.

Taking the subject island effect again, let us consider how this approach explains it under (35):

(36) *$\textbf{Who}$ did [pictures of ***t***] please you?

Suppose that the final relevant representation of (36) is as in (37):

(37) WS = [{$\textbf{who}_3$, {C, {...$\textbf{who}_2$, {T, {...$\textbf{who}_1$, {*v*, ...}}}}}}]

To get a legitimate copy pair of *who*, FC needs to assign the copy relation to the three identical copies: who_3, who_2, who_1. Following Chomsky (in press), let's assume that FC operates at the phase level. Then, in (37), where the CP phase completes, it follows, unless stipulated otherwise, that the three copies of *who* are visible to FC: FC(who_3, who_2, who_1). If FC obeys the binary condition, as stated in (35), then FC(who_3, who_2, who_1) results in a violation of that condition, hence *who* in (37) being not be able to receive an appropriate interpretation at INT. Note that when FC applies to *wh* copies generated at the *v*P phase level (see (16) above), the identical copies always appear only in the base position and in the raised position, so that FC can assign the legitimate copy relation to the relevant copies, without inducing a violation of the binarity condition.

This approach also has some interesting consequences. In this approach, Determinacy is applied to representation, not to derivation, so therefore even if more than two identical copies appear in a derivation, an apparent violation of Determinacy is obviated if those copies are reduced to *two* in the course of the derivation *before* FC is applied. The following data, taken from Merchant (2001: 185), may be relevant to this prediction:

(38) a. ***Which Marx brother** is [a biography of ***t***] going to appear this year?
b. A biography of one of the Marx brother is going to appear this year, but I don't know **which (Marx brother)**.

(39) a. *John said that someone would write a new textbook, but I can't remember **who** John said that ***t*** would write a new textbook.
b. John said that someone would write a new textbook, but I can't remember **who**.

The (a)-cases above show the subject island effect and *that*-trace effect, respectively. Interestingly, as shown in the (b)-cases, these effects are disappeared when deletion is applied. Determinacy at INT may be able to capture these facts as follows. The (a)-cases are bad as FC(who$_3$, who$_2$, who$_1$) violates the binary condition (see (37)). But in the (b)-cases, if who$_2$ is deleted *before* FC applies, as in {who$_3$…~~who$_2$~~…who$_1$}, FC can assign the legitimate copy relation to the relevant copies without inducing a violation of the binary condition, so that *wh* in the (b)-cases being able to receive an appropriate interpretation at INT.

Similarly, the following contrasts, taken from Boeckx (2012: 81), may also be relevant:

(40) a. ***Which woman** did John started laughing [after ***t*** kissed Bill]?

b. (Tell me again) **which woman** was it that John started laughing [after <u>**she**</u> kissed Bill]?

(41) a. ***Who** did Sue read [the claim that ***t*** was drunk] in the Times?

b. **That man**, Sue read [the claim that <u>**he**</u> was drunk] in the Times?

The (a)-cases above show the adjunct island effect and the complex NP island effect, respectively. What is interesting here is that, as shown in the (b)-cases, these effects are disappeared when a copy is replaced with a pronoun. These facts may also be accounted for by Determinacy at INT. First, to accommodate the (a)-cases, we adopt Nakashima's (to appear) Input Determinacy analysis of the adjunct island effect, according to which, (40a) that has the island effect is analyzed as having WS like the following:

(42) WS = [{$\mathbf{wh_3}$, {C, {$_{\text{TP}}$, {$_{\text{CP}}$ $\mathbf{wh_2}$, C'}}}}, {$_{\text{CP}}$ $\mathbf{wh_1}$, C'}]

What is remarkable here is that the copy of the *wh*-phrase, *i.e.* wh$_1$, which is merged within the adjunct clause remains throughout the derivation.

Assuming this, we may be able to account for (40a) as follows in terms of Determinacy at INT: when FC applies to (42) to assign the copy relation to the identical *wh* copies, all the three copies are visible to FC: FC(wh_3, wh_2, wh_1). This violates the binary condition, hence, *wh* in (40a) being not be able to receive an appropriate interpretation at INT. (NB: (40a) may be accounted for under Determinacy at Search, as well: Search(C, wh_2, wh_1) violates the binary condition.) If the relative clause in (41a) is an adjunct (Stowell 1981), (41a) can receives the same account. Under these considerations, the (b)-cases could be explained as follows: since wh_1 in the adjunct clause is replaced by the pronoun *(s)he*, as in {wh_3…wh_2…(s)he}, FC can form a legitimate copy pair of *wh* without violating the binary condition: FC(wh_3, wh_2).

In this way, extending the insight obtained in Input Determinacy to representation, the cases that at first glance seem to cause a violation of Determinacy in the course of derivation may be accommodated in a natural way.

4. Conclusion

In this paper, we first considered the empirical and theoretical consequences of Input/Output Determinacy at MERGE. Then, based on the insights gained from that approach, we discussed what can be said about the other two possible approaches, Determinacy at Search and Determinacy at INT. As we have seen above, each approach has significant consequences and problems. If Determinacy is always available as a third factor, these four approaches may not be mutually exclusive, and if Transfer really exists as an operation, then such an approach like Determinacy at Transfer may also be possible. Needless to say, further research is required.

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