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A Note on the Chain Uniformity Condition in the Minimalist Program

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ABSTRACT: This paper begins with pointing the theoretical weaknesses of the CUC which is based on the uniformity condition (Chomsky (1992) and Chomsky & Lasnik (1993)). To solve the problems, I introduced the refined CUC and Barriers with a new adjunction condition that is adopted from Frampton (1990). Concerning the problems raised by subject/object asymmetry and *wh-in-situ* constructions, I have introduced a [+p] feature (Watanabe (1991) and Chomsky (1992)). However, I have stepped further from them. To have a more general theory, I have separated I-to-C Raising (or [T+AGRs]-to-C Raising) into two parts: the one occurring before Spell-Out by [+p], and the other after Spell-Out by [T+AGRs]. I assumed that erasure of offending traces in the Spec of AGRsP in the overt syntax through L-marking by [+p] does not influence the judgment of grammaticality at all. I have shown that the movement of *Wh-in-situ* at LF can also be explained by the constraints developed in this paper.

1. INTRODUCTION Movement in the Minimalist Program[1] is explained by a set of new constraints such as the Chain Uniformity Condition, the Minimal Link Condition, and Barriers. These movement constraints are different from their predecessors such as the Empty Category Principle and Subjacency in that they do not employ government. Unlike the Empty Category Principle and Subjacency, movement constraints in the minimalist program are all set up to maintain interpretability at the interface, which is the requirement of Full Interpretation. Every object at LF is required to be legitimate for proper interpretation by grammar external systems. If there is an illegitimate object at LF, then the structure will crash. Therefore, as a Last Resort, the grammar has a way to save the structure which will otherwise crash by making illegitimate objects legitimate. Based on [± Uniformity], the Chain Uniformity Condition (CUC) determines what is a legitimate object at LF. Only a non-uniform chain is allowed to delete intermediate traces to become an operator-variable chain which is also a legitimate object at LF. Offending intermediate traces produced by violating movement constraints such as the Minimal Link Condition or Barriers will be deleted as defined in CUC. The deletion of offending intermediate traces of a non-uniform chain, however, will cause a derivational crash, a minor subjacency violation. Any offending trace avoiding deletion until LF will cause a representational crash, an ECP violation.

This paper begins by pointing out the theoretical weakness of CUC based on the same data that were used to support CUC by Chomsky (1992) and Chomsky & Lasnik (1993) (C & L, henceforth). The non-necessity of T-relatedness, which is one of the two backbones of Chomsky (1992) and C & L's CUC, will be explored based on the evidence of complement/non-complement asymmetry, super-raising, head movement, and VP-Fronting, leading to a refinement of CUC. For multiple *Wh*-constructions that escape the refined CUC, I will suggest a refined

Barrier. For the residual problems that avoid the developed constraints, I will introduce a [+p] feature checking that takes place twice in the syntax: once before Spell-Out and once after Spell-Out.

In the interpretation-oriented grammar of the minimalist program, CUC plays a very important role because it defines what is required to have a proper interpretation at LF by grammar external systems. The modification of CUC, therefore, will cause a global adjustment of each constraint within the grammar. The refined Barrier will be one of the results.

2. PROBLEMS WITH THE CUC

This section starts with a brief review of the important concepts and definitions that support Chomsky's (1992) CUC and Barriers. After the review, I will show the application of the CUC and will also show the theoretical weakness of the CUC. The same data on which the CUC has developed will show the necessity of further refining of the CUC.

2.1. Review of Chomsky (1992)'s CUC

Consider the following sentences:

(1) a. What$_i$ do you think [$_{CP}$ t'$_i$ [$_{IP}$ Mary fixed t$_i$]?
b. How$_i$ do you think [$_{CP}$ t'$_i$ [$_{IP}$ Mary fixed the car t$_i$]?
c.??What$_i$ do you wonder [$_{CP}$ whether [$_{IP}$ Mary fixed t$_i$]?
d. *How$_i$ do you wonder [$_{CP}$ whether [$_{IP}$ Mary fixed the car t$_i$]?

Chomsky (1981, 1986) explains the data in (1) by the Empty Category Principle (ECP) and Barriers[2]: (1c) crosses over one barrier, a Subjacency violation, while (1d) crosses over one barrier and violates the ECP as well. In the Minimalist Program (MP), the same data are explained in terms of movement constraints, without employing government. For example, (1a) satisfies the Minimal Link Condition (MLC)[3]. That is, when *What* moves to the Spec of the embedded CP, it neither crosses over any A*-position, nor does the next movement to the Spec of the matrix CP. In the MP, VP is not a barrier because it is L-marked by AGRo. However, IP (=AGRsP) is a barrier because C does not L-mark IP. Therefore, in (1a), *what* adjoins to the embedded and matrix IP to avoid barrierhood.[4] Since the movement of *what* in (1a) crosses over no barrier, it is judged grammatical correctly. The operator movement of *How* in (1b) satisfies MLC and Barriers, so is judged as a grammatical sentence, too. In (1c), the operator movement of *What* does not cross over any barrier, but it violates the MLC, because the movement from the adjoined embedded IP to the adjoined matrix IP crosses over another A*-position, the Spec of embedded CP that is occupied by *whether*. Therefore, the trace of *What* in the adjoined embedded IP is marked * as stated in (2).

(2) When a chain link is formed by Move-α, the trace is assigned * if the economy condition of MLC *requiring "Minimize chain link,"* is violated as it is created. *The structure with * marked trace becomes marginal in its grammaticality.*
(Italics are mine)

A structure with t* is judged as marginal, a weak violation of Subjacency. Therefore, (1c) is judged correctly. In (1d), the operator movement of '*How*' does not cross over any barrier, but it violates MLC by crossing over another A*-position occupied by *whether* in the Spec of the embedded IP. Thus, the trace in the adjoined embedded IP will be assigned *, expecting the same 'marginal' grammaticality as (1c). However, (1d) is completely ungrammatical. To explain this problem, Chomsky (1992) introduces the following conditions.

(4) At LF, the intermediate member(s) of a non-uniform chain must be deleted by Affect-α.

(5) t* remaining at LF results in ungrammaticality.

In (1d), the operator chain produced by the operator movement of '*How*' is "uniform", because all the members of the chain are in A*-positions. Therefore, the condition (4) cannot apply to the intermediate traces of the operator chain of '*How*' in (1d).That is, the offending trace t* is not deleted. As a result, (1d) is judged ungrammatical by the condition in (5). On the other hand, the operator chain of '*What*' in (1c) is "non-uniform", because only the tail member is in an A-position, and the rest are all in A*-positions. Therefore, according to the condition (4), the intermediate members of the chain of (1c) are deleted at LF. And during the process the offending trace t*, which is another intermediate member of the non-uniform chain, is deleted, thereby the structure being correctly judged as marginal.[5]

So far we have briefly reviewed the movement constraints and their application in MP. The seemingly simple shape of the constraints, their application, and the formation of uniform/non-uniform chains are, however, not so simple as they look. Let us consider Chomsky (1992)'s CUC and other major concepts which consist of the main mechanism for the explanation of movement phenomena in the MP.

(6) Chain Uniformity Condition (CUC)
An LF legitimate object[6] is a uniform chain or an operator-variable chain.
A non-uniform chain becomes an operator-variable chain through deletion of its intermediate traces by Affect-α.

(7) Chain Uniformity (CU)
A chain is uniform if the members of the chain are uniform with respect to L-relatedness or T-relatedness or to both, and a chain is non-uniform if the members of the chain are not.

The specifier and complement of a head with an L-feature are L-related in (7). T-related are those positions such as the θ-position, the position of a θ-marker, and the position of a secondary θ-marker. L-related positions are A-positions, and non L-related positions are A*-positions.

As LF legitimate objects, Chomsky (1995:194) admits "only a syntactic chain that satisfies universal morphological requirements." A-chains, head-chains, and adjunct-chains are legitimate uniform chains, and the only non-uniform chain is the operator-variable chain[7]. Non-uniform

chains are produced when the operator in an A-position moves to an A*-position, forming a heterogeneous chain. A heterogeneous chain cannot be interpreted properly by grammar-external systems. Therefore, as a Last Resort to save the structure with a non-uniform chain that will otherwise crash, deletion of intermediate traces occurs.

With all these conditions and concepts in mind, let us discuss the application of the movement constraints. Consider the examples in (8). (8 a&b) is a repeat of (1 c&d).

(8) a.?? What$_i$ do [$_{IP}$ t''$_i$ [$_{IP}$ you wonder [$_{CP1}$ whether [$_{IP}$ t'$_i$ [$_{IP}$ Mary fixed t$_i$]]]]]?
b. * How$_i$ do [$_{IP}$ t''$_i$ [$_{IP}$ you wonder [$_{CP1}$ whether [$_{IP}$ t'$_i$ [$_{IP}$ Mary fixed the car t$_i$]]]]]?

In (8a) *What* moves to the Spec of matrix CP, and in (8b) *How* moves to the Spec of matrix CP. For both cases *Wh*-phrases move to the fronted position via IP-adjunction because IP is a barrier in MP. Both (8a) and (8b) violate MLC, because each *Wh*-phrase crosses over the Spec CP$_1$ which is occupied by another *Wh*-phrase, *whether*. Therefore, the adjoined trace, t'$_i$, will be assigned *. (8a) is a derivational crash, while (8b) is a representational crash: Note that the chain of (8a) is a non-uniform chain allowing the deletion of the star-assigned intermediate trace, while the chain of (8b) is non-uniform, disallowing the deletion of the star-assigned intermediate trace. This difference in deletion causes a difference of grammaticality for each sentence. The uniformity of each chain in (8 a&b) with respect to L-/T-relatedness is shown below:

(9)	a.(=8a)	C = (What, t'', t*', t)				b.(=8b)	C = (How, t'', t*', t)			
	L-Relatedness	−	−	−	+		−	−	−	−
	T-Relatedness	−	−	−	+		−	−	−	−
	⇒ non-uniform wrt both L/T.						⇒ uniform wrt both L/T.			

As we can see from (9), the 'What' chain of (9a) is a non-uniform chain with respect to both L- and T-relatedness. If we delete the intermediate traces of the chain including the offending trace *t**' which resulted from a violation of MLC, then it will become an operator-variable chain. Thus, (8a) is judged correctly as a derivational crash, a weak Subjacency violation. On the other hand, the 'How' chain of (9b) is uniform with respect to both L- and T-relatedness, indicating that the chain in itself is already legitimate at LF. Therefore, an additional operation of Affect-α (deletion of intermediate traces) is not necessary. Thus, the 'How' chain cannot delete the intermediate traces including the offending trace, *t**'$_i$. Since LF does not allow any object with * for Full Interpretation (FI)[8], the LF-form of (9b) crashes. That is, (9b) is judged correctly as a representational crash or an ECP violation.

2.2. Problems of the CUC

In this section, I will show theoretical weaknesses of Chomsky's (1992) CUC, based on the same data he used for his CUC.

Concerning the issue of chain uniformity with respect to L-/T-relatedness as stated in (7), Chomsky (1992) argues for the necessity of both. He asserts that in order to explain the data showing subject/object asymmetry listed as (10) below, we need to maintain both L-/T-

relatedness within the CUC. Unlike his assertion, however, the asymmetry data cannot be properly dealt with whether we keep both L- and T-relatedness, or we keep L-relatedness only. Consider the structures in (10):

(10) a. ?? Who$_i$ do [$_{IP}$ t'''$_i$ [$_{IP}$ you wonder [$_{CP}$ whether [$_{IP}$ t*''$_i$ [$_{IP}$ we believed [$_{IP}$ t'$_i$ [$_{IP}$ we helped t$_i$]]]]]]]
b. * Who$_i$ do [$_{IP}$ t'''$_i$ [$_{IP}$ you wonder [$_{CP}$ whether [$_{IP}$ t*''$_i$ [$_{IP}$ we believed [$_{IP}$ t'$_i$ [$_{IP}$ t$_i$ helped us]]]]]]]

Chomsky's explanation for (10 a&b) is as follows: In (10a), only the tail member of the '*Who*' chain is [+L] and [+T] since the object position of *helped* is a θ-position, while the other members are all [-L] and [-T]. On the other hand, in (10b), the tail member of the chain is [+L] and [-T][9], while the others are all [-L] and [-T]. Therefore, the chain in (10a) is a non-uniform chain which allows deletion of the intermediate traces including the offending trace $t^{*''}_i$, and is correctly judged as a derivational crash. On the other hand, in (10b), the chain is uniform with respect to [-T-relatedness], preventing the intermediate traces including the offending trace $t^{*''}_i$ from being deleted, thereby resulting in a representational crash, which is a correct prediction.

The explanation by Chomsky, which is based on CUC with [L-/T-relatedness], however, has a theoretical problem. Before we go further, let us reconsider the previous discussion of (8) which is repeated as (11) and (12).

(11) a. ?? What$_i$ do [$_{IP}$ t''$_i$ [$_{IP}$ you wonder [$_{CP}$ whether [$_{IP}$ t*'$_i$ [$_{IP}$ Mary fixed t$_i$]]]]?
b. * How$_i$ do [$_{IP}$ t''$_i$ [$_{IP}$ you wonder [$_{CP}$ whether [$_{IP}$ t*'$_i$ [$_{IP}$ Mary fixed the car t$_i$]]]]?

(12) a.(=12a) C = (What, t'', t*', t) b.(= 12b) C = (How, t'', t*', t)

L-Relatedness	−	−	−	+	L-Relatedness	−	−	−	−
T-Relatedness	−	−	−	+	T-Relatedness	−	−	−	−

The chain defined by CU is clearly an LF chain. However, decision of the chain uniformity for the *Wh*-movement of '*What*' in (11a) is not as simple as is shown in (12a), since the first trace of '*What*', that is, t_i, in (12a) must keep moving to the Spec of AGRoP at LF. This movement produces another A-chain with its tail in the object position of the verb *fixed* and its head in the Spec of AGRoP. Thus, in the LF-form of (11a), the trace in the complement position of *fixed* becomes the starting point of the operator-variable chain as well as the starting point of an A-chain at the same time. However, this situation is theoretically unacceptable because in such a situation the variable, that is, the *Wh*-trace in the object position of *fixed*, is bound by the A-trace in the Spec of AGRoP, thereby resulting in the violation of the Binding Principle C.

In order to avoid this problem, Chomsky adjusts the operator-variable chain: "The operator-variable chain starts from the Spec of AGRoP." This adjustment is assumed to be costless. Basically interpretation of a chain at LF does not consider the process of chain formation. It just depends on the result of the formed chain. Thus, such chain adjustment as this is automatically done in order to avoid violation of Binding Principle (C). However, this chain adjustment raises another serious problem. It is true that the Spec of AGRoP as a starting point of the operator-variable chain at LF enables us to avoid violation of Binding Principle (C). This adjustment, however, makes the resulting chain become a uniform chain with respect to [-T-relatedness], thereby disallowing deletion of the intermediate offending trace t*'$_i$, and resulting in

the incorrect prediction of a representational crash.

The same argument we are developing against Chomsky's CUC is also true of (10 a&b). Note that (10 a&b) show the subject/object asymmetry which Chomsky introduces to argue for the necessity of [T-relatedness] for his CUC. The following sentences in (13) are a repeat of (10).

(13) a. ?? Who_i do $|_{AGRsP3}$ t'''_i $[_{AGRsP3}$ you wonder $[_{CP1}$ whether $|_{AGRsP2}$ $t*'''_i$ $|_{AGRsP2}$ we believed
[-L/-T] [-L/-T] [-L/-T]
$|_{AGRsP1}$ t''_i $[_{AGRsP1}$ we $|_{AGRoP1}$ t'_i $[_{VP1}$ helped t_i]]]]]]]]]?
[-L/-T] [+L/-T]

b. * Who_i do $[_{AGRsP3}$ t'''_i $|_{AGRsP3}$ you wonder $[_{CP1}$ whether $[_{AGRsP2}$ $t*'''_i$ $[_{AGRsP2}$ we believed
[-L/-T] [-L/-T] [-L/-T]

$[_{AGRsP}$ t'_i $|_{AGRsP1}$ t_i $[_{VP1}$ helped us]]]]]]]]?
[-L/-T] [+L/-T]

As we have already discussed for (11a), the operator-variable chain in (13a) should start from the Spec of $AGRoP_1$, and the trace t'_i, a tail member of the chain, is [+L] and [-T] within Chomsky's CU in (7). Therefore, the chain becomes a uniform chain with respect to [-T], resulting in incorrect prediction of grammaticality. As (13a) clearly shows, if we admit [T-relatedness] as one of the two sub-conditions of the CU, then (13a) is judged incorrectly. Therefore, for correct prediction of grammaticality of (13a), we reach the conclusion that [T-relatedness] should not be included in the CU.

(13b), however, tells us a different story. In (13b) '*Who*' first A-moves from the Spec of the VP_1 to the Spec of $AGRsP_1$, and then A*-moves to the Spec of the matrix CP. Since the operator-variable chain headed by '*Who*' starts from the Spec of $AGRsP_1$, the tail member of the chain is [+L] and [-T]. The chain becomes a uniform chain with respect to [-T] within Chomsky's CUC, disallowing deletion of the intermediate traces including the offending trace $t*''_i$ in the Spec of adjoined $AGRsP_2$, and so (13b) is judged to be ungrammatical as it is. Therefore, for a correct prediction of the grammaticality of (13b), [T-relatedness] should be included in the CU. (Note that the operator-variable chain of (13b) would form a non-uniform chain in terms of [L-relatedness], resulting in an incorrect prediction.)

To summarize, unlike Chomsky (1992)'s assertion, inclusion of [T-relatedness] in the CUC does not explain the subject/object asymmetry properly as we have discussed so far. That is, inclusion of [T-relatedness] in the CU cannot offer a correct prediction of a derivational crash to (13a), whereas exclusion of [T-relatedness] from the CUC cannot offer correct prediction of a representational crash (13b). Therefore, Chomsky's CU defined in (11) needs further refining.

In the next section, I will explore the possibility of CU without [T-relatedness].

3. NON-NECESSITY OF [T-Relatedness]

In this section we will discuss the possibility of THE CU without [T-relatedness]. I will introduce some syntactic evidence that can be clearly explained without [T-relatedness]. The refined CUC is more general than its predecessor.

It is not difficult to find data which can be explained by CUC without [T]. The data in 3.1 in the following are strong evidence to argue that [T] should not be there in CUC, and the data in 3.2 to 3.4 also indicate that we may manage it without [T].

3.1. SUPER-RAISING

Super-raising phenomena provide strong evidence for CUC without [T]. Consider (14):

(14) *John$_i$ seems $[_{AGRsP}$ it is certain $[_{AGRsP}$ t*'$_i$ $[_{VP}$ t_i to win]]].
[+L/-T] [+L/-T] [+L/+T]

In (14) the chain headed by '*John*' has [+T] as its tail, but the other members are all [-T], thus the chain is non-uniform with respect to [-T]. Note, however, that the chain is uniform with respect to [+L] because every member is in an L-related position. If we maintain the chain uniformity with respect to [T] over [L], then an incorrect prediction immediately follows because the offending intermediate trace $t^{*'}_i$ will be deleted, thereby resulting in a derivational crash. This evidence, therefore, leads us to retaining [L] over [T].

3.2. OBJECT/ADJUNCT ASYMMETRY

Let us reconsider the sentences of (11) and their chain uniformity of (12) which are listed below as (15) and (16) respectively.

(15) a.??What$_i$ do $[_{AGRsP2}$ t''$_i$ $[_{AGRsP2}$ you wonder $[_{CP}$ whether $[_{AGRsP1}$ t*'$_i$ $[_{AGRsP1}$ Mary $[_{AGRoP}$ fixed t_i]]]]]
b.*How$_i$ do $[_{AGRsP2}$ t''$_i$ $[_{AGRsP2}$ you wonder $[_{CP}$ whether $[_{AGRsP1}$ t*'$_i$ $[_{AGRsP1}$ Mary fixed the car t_i]]]]]?

(16)

a. C = (What, t'', t*', t)					b. C = (How, t'', t*', t)				
L-Relatedness	–	–	–	+	L-Relatedness	–	–	–	–
T-Relatedness	–	–	–	+	T-Relatedness	–	–	–	–

The sentences (15 a&b) do not suggest anything concerning one condition over the other of CU. What the chain uniformity in (16 a&b) only suggests is that we don't need both [L] and [T]. However, (15 a&b) may work as indirect evidence for discarding [T] from CU because we still can make a correct prediction of the grammaticality for the sentences at hand without [T].

3.3. HEAD MOVEMENT

Next let us analyze (17), a head movement construction.

(17) *Have$_i$ [$_{AGRsP}$ I should t*$_i$ studied Event Structure]?
[+L/-T] [+L/-T]

The *have* chain is uniform with respect to both [L/T], resulting in violation of FI because of the offending trace t*$_i$. Thus we can explain (17) in terms of only [L] again, another indirect evidence for [L] only.

3.4. VP-PREPOSING

The following example of VP-Preposing also provides strong evidence for the argument that [T] is unnecessary for CU. Consider:

(18) ?? [$_{AGRsP2}$ [$_{VP}$ Read the book]$_i$ [$_{AGRsP2}$ I wonder [$_{CP}$ whether [$_{AGRsP1}$ t*'$_i$ [$_{AGRsP1}$ he ever will t$_i$]]]]]
[-L/-T] [-L/-T] [+L/+T]

In (18) the VP adjoins to the matrix $AGRsP_2$ via adjunction to $AGRsP_1$. Since VP-movement crosses over the Spec of CP, the first intermediate trace becomes an offending trace *t**'$_i$. The VP-chain has its tail with [+L] and [+T], and the others with [-L] and [-T]. The tail member of the VP-chain is [+L] because T, *will,* is a head category including an L-feature, and VP is a complement of T. The tail member of the VP-chain is [+T] because VP is a secondary θ-marker[10]. Thus the VP-chain in (18) is non-uniform with respect to both [L/T]. Thus, again for VP-Preposing [T-relatedness] as a condition of CU is not necessary.

Based on the evidence we have discussed so far, we can suggest the refined minimized CU as follows:

(19) Chain Uniformity (*Refined*)
A chain is uniform if the members of the chain are uniform with respect to L-relatedness, and a chain is non-uniform if the members of the chain are not.

Note that by refining the CU as (19), actually we have introduced a change to the CUC as well. The new CUC which is based on the refined CU could be named a refined CUC.

In the following section, I will show the application of the new CU to both overt and covert movement. Many controversial movement phenomena will be dealt with by applying the refined CUC and a modified definition of Barriers which include the adjunction condition as its subcondition.

4. APPLICATION

In this section I will apply the refined CUC to some overt movement cases as well as to covert movement. Note that unlike the general trend of the MP perspective which asserts that *Wh-in-situ* does not move (for detailed discussion, see Stroik(1992, 1995) and Reinhart(1998) among others), I will depend on a movement approach. For the cases which avoid the refined CUC, modified Barriers will help explain the cases. In 4.1. I will show the cases the refined CUC fails to explain. In 4.2. I will show they can be explained by means of the refined CUC and modified

Barrier.

4.1. Problems of the refined CUC and the solution

4.1.1. Subject/Object asymmetry in Overt movement

The refined CUC does not show any problem in predicting the grammaticality of the sentences showing object/adjunct asymmetry. The examples in (15) and (16) in 3.2 showed that movement of the Direct Object will result in a non-uniform chain and the offending trace will delete, a derivational crash. In contrast, movement of an adjunct will result in a uniform chain and the remaining t^* at LF will cause a representational crash.

However, there arises a problem in explaining subject/object asymmetries. Pesetsky's asymmetry sentences are repeated as (20). Consider:

(20) a. ?? Who_i do $[_{AGRsP3}$ t'''_i $[_{AGRsP3}$ you wonder $[_{CP1}$ whether $[_{AGRsP2}$ $t^{*''}_i$ $[_{AGRsP2}$ we believed
[-L] [-L] [-L]

$[_{AGRsP1}$ t''_i $[_{AGRsP1}$ we $[_{AGRoP1}$ t'_i $[_{VP1}$ helped t_i]]]]]]]]?
[-L] [+L] → Non-uniform

b. * Who_i do $[_{AGRsP3}$ t'''_i $[_{AGRsP3}$ you wonder $[_{CP1}$ whether $[_{AGRsP2}$ $t^{*''}_i$ $[_{AGRsP2}$ we believed
[-L] [-L] [-L]

$[_{AGRsP1}$ t'_i $[_{AGRsP1}$ t_i $[_{VP1}$ helped us]]]]]]]]?
[-L] [+L] → Non-uniform

The operator-variable chain of (20a) starts from the Spec of $AGRoP_1$, forming a non-uniform chain which allows deletion of the offending intermediate trace $t^{*''}_i$, thus resulting in a derivational crash, a correct prediction. However, for (20b), the prediction of the revised CUC fails. To look at the derivation more closely, the operator-variable chain starts from the Spec of $AGRsP_1$, forming a non-uniform chain by landing in a [-L] position of the Spec of matrix CP. Thus another derivational crash is predicted by the grammar, which is not the case. We expect a representational crash given the degree of ungrammaticality. Thus, a serious problem for the refined CUC. In the following section, I will show that this problem in the overt syntax is solved by the CUC and a revised Barriers equipped with a new adjunction condition.

4.1.2. Subject/Object Asymmetry in Covert Movement

The refined CUC also fails for the following covert movement cases. Consider the data that are showing another subject/object asymmetry:

(21) a. ?*It is unclear who thinks (that) who saw us.
b. It is unclear who thinks (that) we saw whom.

(22) a. *I know perfectly well who thinks (that) who is in love with him.
b. I know perfectly well who thinks (that) he is in love with whom.

(23) a. *I wonder where who bought this record.
b. I wonder where John bought what.

All the data from (21) to (23) show a subject/object asymmetry exhibited by *Wh-in-situ*.[11] Many dialects of English do not generally allow constructions with a subject *Wh-in-situ* as in (21a), (22a), and (23a). They are different from the constructions with an object *Wh-in-situ* as in (21b), (22b), and (23b), which produce legitimate pair readings. The contrast shows that the so-called subject/object asymmetry also exists in *Wh-in-situ* constructions.

Supposing that Move-α applies to *WH-in-situ* successive cyclically at LF as it does in the overt syntax, the relevant structures for (21a) and (22a) will be as follows:[12]. (Note that application of the refined CUC also fails to explain the same data. The VP-internal Subject Hypothesis does not help, either).

(24) a. ?* ...[$_{CP}$ who$_j$, who$_i$ [$_{AGRsP2}$ t'''$_j$ [$_{AGRsP2}$ t$_i$ thinks [$_{CP}$ t''$_j$ [$_{AGRsP1}$ t'$_j$ [$_{AGRsP1}$ t$_j$ saw us]]]]
[-L] [-L] [-L] [-L] [+L]

→ Non-uniform Chain

b.[$_{CP2}$ who$_j$, who$_i$ [$_{AGRsP2}$ t''''$_j$ [$_{AGRsP2}$ t$_i$ thinks [$_{CP1}$ t'''$_j$ [$_{AGRsP1}$ t''$_j$ [$_{AGRsP1}$ we [$_{AGRoP2}$ t'$_j$ [$_{VP}$ saw t$_j$]]]]]
[-L] [-L] [-L] [-L] [+L]

→ Non-uniform Chain

As we can see from the derivation, still (24a), extraction from the subject *Wh-in-situ* in (24a) is not explained properly.

In spite of the seemingly complex situations, the data which raise a big problem for either version of CU reveal something we cannot ignore. Consider (25) below which is a collection of the problematic structures:

(25) a. Overt Movement Before Spell-Out (=20b)

* Who$_i$ do [$_{AGRsP3}$ t''''$_i$ [$_{AGRsP3}$ you wonder [$_{CP1}$ whether [$_{AGRsP2}$ t*'''$_i$ [$_{AGRsP2}$ we believed
[-L] [-L] [-L]

[$_{CP}$ t''$_i$ [$_{AGRsP1}$ t'$_i$ [$_{AGRsP1}$ t$_i$ [$_{VP1}$ t helped us]]]]]]]]?
[-L] [-L] [+L]

→ Non-uniform Chain

b. Covert Movement After Spell-Out (=21a=24a)

?*...[$_{CP}$ who$_j$, who$_i$ [$_{AGRsP2}$ t'''$_j$ [$_{AGRsP2}$ t$_i$ thinks [$_{CP}$ t''$_j$ [$_{AGRsP1}$ t'$_j$ [$_{AGRsP1}$ t$_j$ saw us]]]]
[-L] [-L] [-L] [-L] [+L]

→ Non-uniform Chain

Recall that *Wh*-movement in (25a) forms a non-uniform chain, with a derivational crash expected, an incorrect judgment, whereas (25b) which experiences covert LF *Wh*-movement forms a non-uniform chain again with no violation expected, another incorrect judgment again. Both structures are concerned with the subject positions as a starting point of the operator-variable chain.

To solve this problem, I will employ Frampton's (1990:53) 'Head Government Condition on Adjunction' which blocks adjunction to IP by IP-Spec. Frampton assumes that "a *Wh*-element can only be adjoined to a maximal projection of XP from a position that is canonically governed by the head of XP." The direction of canonical government in English is to the right. His notion may be restated as (26) to fit into the MP.

(26) Condition on Adjunction[13]
An XP can adjoin to a maximal projection HP only if the XP is c-commanded by the head H.

The definition (26) does not refer to either directionality of government or government itself. Spec of AGRsP is not c-commanded by Agrs+T, so a subject DP cannot adjoin to AGRsP which directly dominates it. On the other hand, an object DP can adjoin to AGRsP because it is c-commanded by Agrs+T. Under the adjunction condition, the operator-variable chains of (25 a&b) also change. Consider the newly formed chains and their implication.

(27) a. Overt Movement Before Spell-Out (Compare with (25a))

* Who$_i$ do [$_{AGRsP3}$ t'''$_i$ [$_{AGRsP3}$ you wonder [$_{CP1}$ whether [$_{AGRsP2}$ t*''$_i$ [$_{AGRsP2}$ we believed

[$_{CP}$ t'$_i$ [$_{AGRsP1}$ t*$_i$ [$_{VP1}$ t helped us]]]]]]]]?

b. Covert Movement After Spell-Out (Compare with (25b))

?* ...[$_{CP}$ who$_j$, who$_i$ [$_{AGRsP2}$ t$_j$'' [$_{AGRsP2}$ t$_i$ thinks [$_{CP}$ t'$_j$ [$_{AGRsP1}$ t*$_j$ saw us]]]]

Recall that either Chomsky's CUC in (6) or the refined CUC based on the CU in (19) alone fails to explain the above data correctly. Now with the adjunction condition and the newly formed chains based on it, let us see if the refined CUC works for the problematic cases.

For the chain in (27a), which is produced by overt movement, it is still non-uniform. Therefore, the offending intermediate *t**'' is deletable. But, we still have the tail member of the operator-

variable chain, $\underline{t^*_i}$. This trace avoids deletion because it is not an intermediate trace. The offending trace remaining at LF will, therefore, crash the structure, a correct prediction.

Next, let us think of the chain of (27b). The chain is non-uniform. However, we cannot delete the offending trace $\underline{t^*_i}$ because it is the tail member trace. This seems to raise a problem for the theory we are developing. But, the difference between the offending non-intermediate traces in both constructions above immediately suggests a solution to the problem. Note that the offending tail trace of (27a) is produced before Spell-Out, whereas the tail trace with * of (27b) is produced after Spell-Out. Both traces remain at LF. But, we can expect that the trace produced by illegal movement before Spell-Out will cause more serious influence on the grammaticality of the structure than that after Spell-Out. And expecting that there should be a difference in the grammaticality is not inconsistent with the MP theory at all.[14] Therefore, we can still maintain that we explain the grammatical difference between (27a) and (27b) correctly.

Until now I have developed a minimized CU, the one based solely on L-relatedness. In addition, I have employed an adjunction condition for Barriers in the MP, thereby showing that the CUC together with Barriers can explain the problematic movement cases, both overt and covert.

5. RESIDUAL PROBLEMS AND FURTHER DISCUSSION

The theory we have developed is based on the following five assumptions:
(1) the refined CUC based on the CU without [T]; (2) Modified Barriers with a new adjunction condition which bars adjunction of Spec-AGRsP to the immediately dominating AGRsP; (3) *Wh-in-situ* moves at LF; (4) Violation of movement constraints before Spell-Out is more costly than after Spell-Out. In this section I will discuss data which could be counter-arguments to the theory we have developed. Consider the following sentence and its LF-structure with respect to the chain uniformity:

(28) a. Who knows what?
b. Who$_i$ [$_{AGRsP}$ t*'$_i$ [$_{VP}$ t$_i$ knows what]]]?[15]
|-L| [+L]
$\Rightarrow$ Non-uniform chain, but t*'$_i$ undeletable

The sentence (28) is grammatical. However, if we apply the refined CUC and Barriers with the adjunction condition, then we have a wrong prediction: The adjunction condition will block adjunction of '*Who*' to AGRsP. The crossing over of the Barrier AGRsP will assign * to the trace in the Spec of AGRsP. The *-marked trace is not an intermediate trace, thus it cannot be deleted.

As one possible solution, we may admit the head-movement of INFL (or the amalgam of [T+AGR$_S$]) to C. As assumed, T and AGR as well as V include lexical features in the MP. Therefore, after the amalgam with lexical features moves to C, it may disable the barrierhood of the AGRsP. Then no offending trace will be produced.[16] This approach may work for sentence (28) above. However, it fails for (27 a&b), which are repeated as (29).

(29) a. Overt Movement Before Spell-Out

* Who_i do $[_{AGRsP3}$ t'''_i $[_{AGRsP3}$ you wonder $[_{CP1}$ whether $[_{AGRsP2}$ $t*''_i$ $[_{AGRsP2}$ we believed $[_{CP}$ t'_i $[_{AGRsP1}$ $\underline{t*_i}$ $[_{VP1}$ t helped us]]]]]]]]?

b. Covert Movement After Spell-Out

?* ...$[_{CP}$ who_j, who_i $[_{AGRsP2}$ t_j'' $[_{AGRsP2}$ t_i thinks $[_{CP}$ t'_j $[_{AGRsP1}$ $\underline{t*_j}$ saw us]]]]

The approach discussed above may save the production of $\underline{t*_1}$ in the Spec of $AGRsP_1$ in (29a). However, without $\underline{t*_i}$, we cannot explain the ungrammaticality of the structure correctly. Note that we cannot depend on the controversial status of *whether* as an X^0 category. Whatever *whether* does to maintain the barrierhood of the $AGRsP_2$, the offending trace would still be an intermediate trace, and will be deletable. We meet the same situation in (29b).

The next possible solution will be to assert that "the top-most maximal projection is otherwise AGRsP." With this assumption in mind, let us think about the following analysis which is a repeat of (28).

(30) a. Who knows what?

b. $[_{AGRsP}$ Who_i $[_{VP}$ t_i knows what]]]?
[+L]
⇒ Uniform chain with no offending trace

(30b) will be the entering structure of (30a) at LF. The structure produced before Spell-Out does not raise any problem. But, at LF, we assume that every *Wh-in-situ* must experience movement to the proper A*-position. The structure after LF-movement will be as follows:

(31) $[_{CP}$ $what_j$, who_i $[_{AGRsP}$ t''_j/ t''_i $[_{AGRsP}$ t'_i $[_{AGRoP}$ t'_j $[_{VP}$ t_i knows t_j]]]?
[-L] [-L] [-L] [+L]
[-L] [-L] [+L]

There is no problem with the *What*-chain. The *Who*-chain again confronts the same situation as we discussed for (29a).

To solve the problem we have now, let us employ [+p] licensing (refer to footnote (16) for a brief explanation) following Watanabe (1991) and Chomsky (1992). They assume a [+p] feature[17] in AGR. Once there is a trace in the Spec of AGRsP, then a feature [+p] is created. After it licenses the trace in the subject position, [+p] raises up to an empty C, and there it is licensed by C and checked. But, to these properties of [+p] assumed by Watanabe and Chomsky, I will add that the feature [+p] must raise before Spell-Out. This is a kind of I-to-C Raising before Spell-Out. Note that I-to-C raising takes place after Spell-Out once more. The difference of levels on which each raising takes place-- that is, raising of [+p] to C before Spell-Out, and raising of I-to-C at LF-- will offer some clue to the issue we are blocked by. Let us consider (31) again. The barrierhood of AGRsP for the *Who*-chain will be lost by I-to-C raising at LF. Thus, *Who* can

move to the Spec of CP with no Barrier crossed. We are already familiar with the problem this explanation will confront through the discussion on the case of (29b), a covert movement at LF. The difference between (29b) and (30) is again movement before and after Spell-Out. Therefore, let's get back to the widely assumed position of vacuous movement of *Who* in *Who knows what.* (32) contains (29b) and (28).

(32) a. ?* ...[$_{CP2}$ who$_j$, who$_i$ [$_{AGRsP2}$ t$_j$'' [$_{AGRsP2}$ t$_i$ thinks [$_{CP1}$ t'$_j$ [$_{AGRsP1}$ t*$_i$ saw us]]]]

b. [$_{CP}$ Who$_i$ [$_{AGRsP}$ t*'$_i$ [$_{VP}$ t$_i$ knows what]]]?

Let us discuss (32b) first. We assume that [+p] is also a lexical feature. If we move [+p] to the C after it licenses the trace in the Spec of AGRsP, then there is no offending trace, because the barrierhood of AGRsP is lost due to the L-marking by the lexical [+p]. The assumption that overt *Wh-* movement and [+p]'s licensing the subject trace and subsequent moving to C take place at the same time will be necessary to hold. Then, we can find no problem for (32b).

Next, consider the chain in (32a). (32a) includes a chain produced at LF and it raises a problem. Let us move the *Wh-in-situ,* that is *who,* to the Spec of CP_1. The trace in the Spec of $AGRsP_1$ will get * due to crossing over one barrier. However, the trace can avoid becoming an offending trace: LF I-to-C raising of the lexical features nullifies the barrierhood of the $AGRsP_1$. Then, the movement does not have any illegal trace at all to the Spec of CP_2. In this stage, we have to recall that there is a trace in the Spec of $AGRsP_1$, and the trace must be licensed by a [+p] feature. Note that we assumed that the [+p] feature must raise up to an empty C before Spell-Out, and the trace in the Spec of $AGRsP_1$ is produced after Spell-Out. Therefore, the trace in the Spec of $AGRsP_1$ cannot be licensed by [+p][18] through Spec-head checking.

To prove the validity of the theory we have just discussed, let us take some more examples. Compare the two sentences:

(33) a. [$_{CP}$ Who$_i$ [$_{C'}$ [$_{AGRsP}$ t$_i$ [$_{VP}$ saw Supath]]]?
b.*[$_{CP}$ Who [$_{C'}$ did [$_{AGRsP}$ t*$_i$ [$_{VP}$ saw Supath]]]]?

I will leave the explanation of (33a) to the reader. For (33b), the offending trace in the Spec of AGRsP which is produced by one barrier crossing-over can not be saved, because the C to which [+p] will move to is already filled by '*did*', and therefore, the barrierhood cannot be avoided. The chain is non-uniform. However, the offending trace is not an intermediate trace, and therefore, no deletion is allowed.

6. CONCLUSION

In this paper I have shown the problems for Chomsky's (1992) CUC which is based on the uniformity condition. To solve the problems, I introduced the refined CUC and Barriers with a new adjunction condition that is adopted from Frampton (1990). Concerning the problems raised by subject/object asymmetry and *wh-in-situ* constructions, I have introduced a [+p] feature, adopting Watanabe (1991) and Chomsky (1992). However, I have stepped further from them. To

have a more general theory, I have separated I-to-C Raising (or [T+AGRs]-to-C Raising) into two parts: the one occurring before Spell-Out by [+p], and the other after Spell-Out by [T+AGRs]. I assumed that erasure of offending traces in the Spec of AGRsP in the overt syntax through L-marking by [+p] does not influence the judgment of grammaticality. I have shown that the movement of *Wh-in-situ* at LF can also be explained by the constraints developed in this paper.

NOTES

1. The discussion in this paper is largely based on the early stage Minimalist Program as laid out in Chomsky (1992), Chomsky & Lasnik (1992) and Chomsky (1993). Chomsky (1993) does not include much of the hot discussion concerning multiple Wh-movement and Chain Uniformity which was done in the fall semester syntax class at MIT in 1992. This paper starts from pointing out the problems of the unfinished discussion on multiple Wh-movement and Chain Uniformity.

2. For the movement theory without employing government, MP suggests the following conditions:

(1) Barriers
A barrier is a category that is not L-marked.

(2) L-marking
A category that contains a lexical feature L-marks its complememt and the daughter(s) of the complememt.

If α moves crossing over a barrier or other movement condition(s) such as the Minimal Link Condition, then the trace is assigned *. The structure including t* becomes marginal in its grammaticality.

3. The Minimal Link Condition (MLD)
Minimize chain links.

4. Another way to avoid barrierhood of IP is to assume that tensed INFL head-moves to adjoin to C, and the resulting INFL+C L-marks IP. This is a plausible assumption because though C does not have any lexical features, INFL, especially AGRs is assumed to include an N-feature and a V-feature for checking ϕ-features of the DP and Verb.

5. When a structure is assigned offending traces due to an illegal operation, resulting in marginal grammaticality, it is called a derivational crash (that is, a Subjacency violation in the P&P approach); when the offending traces are not deleted until LF, thereby resulting in ungrammaticality of the structure, it is called a representational crash (that is, an ECP violation under the P&P approach).

6. Legitimate objects at LF are all chains. A-chain, head-chain, adjunct-chain are uniform and legitimate chains at LF. The Operator-Variable chain is the only non-uniform chain that is legitimate at LF. Thus, every non-uniform chain must go through deletion of intermediate traces to be an operator-variable chain. Or, they cannot get interpreted, which means all non-uniform chains at LF except the operator-variable chain will crash the structure.

7. Operator-variable chain
As an LF object, an operator-variable chain consists of the operator and the variable only.

8. Principle of Full Interpretation
Every element at the interface (PF and LF) must be a legitimate object to be interpreted by the grammar-external systems.

9. Spec of IP, which is occupied by the tail member t of the chain, is a non-θ position under the VP- Internal Subject Hypothesis.

10. VP as a secondary θ-marker is confirmed by the following examples. Consider:

a. It only seems that John is angry.
b. $[_{AGRsP}$ John$_i$ only $[_{VP}$ seems $[_{AGRsP}$ t'$_i$ to $[_{VP}$ t$_i$ be angry].

(a) and (b) are slightly different in their meaning. In (b), the subject has a quasi-agentive role assigned by the VP, a secondary θ-marker, which is headed by *seem*. *seem* does not assign any θ-role alone. In (b), however, the position of *John* which is assigned a quasi-agentive role is not a T-related position at all as is defined in (4) which is repeated below.

T-Relatedness
The θ-position, the position of a θ-marker, and the position of a secondary θ-marker are T-related.

11. Chomsky (1993) assumes that LF Wh-movement, that is, movement of Wh-in-situ, is not Move-α but the syntactic basis for Absorption which is an operation for semantic interpretation. However, there has been no detailed suggestion for this interpretation approach yet. Thus in this paper I will not accept the interpretation approach. Rather I will investigate syntactic properties of multiple Wh-questions in English.

12. For contrast's sake the analysis of (21a&b) is done by Chomsky's CUC. Consider:

(21a) ?*...$[_{CP}$ who$_j$, who$_i$ $[_{AGRsP2}$ t$_i$ thinks $[_{CP}$ t'$_j$ $[_{AGRsP1}$ t'$_j$ $[_{AGRsP1}$ t$_j$ saw us]]]]
[-L] [-L] [-L] [+L]
[-T] [-T] [-T] [-T]

→ Uniform Chain with respect to [-T]

(21b)...[$_{CP}$ who$_j$, who$_i$ [$_{AGRsP2}$ t_i thinks [$_{CP}$ t'_j [$_{AGRsP1}$ t'_j [$_{AGRsP1}$ we saw t_j]]]]
[-L] [-L] [-L] [+L]
[-T]]-T] [-T] [+T]

→ Non-uniform Chain

In (21a), the LF movement of *who* produces a uniform chain with respect to [-T]. As we see from the derivation, extraction of the subject *Wh-in-situ* from AGRsP$_1$ does not cross over any barrier due to IP (AGRsP)-adjunction. Therefore, this derivation cannot rule out (21a) as ungrammatical. On the other hand, there is no problem in predicting the grammaticality of (21b) correctly.

13. This adjunction condition constrains illegal movement. Therefore, it can be included as a sub-condition of the Barriers in the MP. 'Barriers' in the early MP is still a required concept to explain the following data. Consider:

a.*How$_i$ did [$_{IP}$ t'''$_i$ [$_{IP}$ you [$_{VP}$ leave [$_{PP}$ before [$_{CP}$ t''$_i$ [$_{IP}$ t'$_i$ [$_{IP}$ you [fixed the car t_i]]]]]]]]
b.*Who$_i$ did [$_{IP}$ t'''$_i$ [$_{IP}$ you [$_{VP}$ meet Mary [$_{PP}$ before [$_{CP}$ t''$_i$ [$_{IP}$ t'$_i$ [$_{IP}$ PRO [$_{VP}$ interviewing t_i]]]]]]]]?

(a) & (b) observe MLC because there is no intervening XP in the Spec of CP's. However, they are ungrammatical. Therefore, to explain (a&b), we still need the condition of Barriers in the MP.

14. Offending traces at LF which cause a marginal reading of a structure, rather than crashing the structure, may be a big challenge for the MP requiring that every object at LF should be legitimate for Full Interpretation from grammar-external systems.

15. Chomsky's CUC and Barriers can explain the grammaticality of the following sentence without problem. Consider:

Who$_i$ [$_{AGRsP}$ t''$_i$ [$_{AGRsP}$ t'$_i$ [$_{VP}$ t knows what]]]?
[-L/-T] [-L/-T] [+L/-T]

The chain is non-uniform with respect to [+L], and there is no offending intermediate trace(s).

16. The I-to-C Raising and the [+p] licensing work for the explanation of *that*-t effect in English. [+p] is one of the features of AGR. It licenses the trace in the Spec of AGRsP, and then it needs to be licensed by C. But, the licensing is only possible when C is empty. It does not look nice to assume an abstract feature like [+p], but it works.(Watanabe 1991, Chomsky 1992)

Consider the following sentences:

a. Who do you think [$_{CP}$ t' [$_{AGRsP}$ t*$_i$ bought a book]]?
b * Who do you think [$_{CP}$ t' that [$_{AGRsP}$ t*$_i$ bought a book]]?

The two sentences show the same chain structure: both of them include one offending trace in the tail. But, they show different grammaticality. I-to-C Raising and [+p] licensing offer an explanation for the difference.
For (a), the barrierhood of the AGRsP will be avoided through L-marking by the amalgam of [T+AGR] which is raised to C. [+p], after licensing the trace in the Spec of AGRsP, raises to the empty C, and gets licensed by C. For (b), I-to-C raising and avoidance of the barrierhood of AGRsP are the same as (a). But, [+p] cannot raise to C, because it is occupied. Therefore, the unchecked [+p] will crash the structure.

17. The [+p] feature is assumed as a kind of grammatical feature for person. You may argue that there is no clear difference or that it is redundant with the ϕ-features which include person, number, and gender.

18. This explanation actually changes the cases of the CUC and Barrier violation to a feature-licensing failure.

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