A THEORY OF LINEARIZATION AND ITS IMPLICATION FOR BOUNDEDNESS OF MOVEMENT

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The purpose of this paper is to propose within the framework of the Minimalist Program that linear order within a phase domain is determined by the Linear Correspondence Axiom, whereas linear order within a non-phase domain is determined by the head parameter. Furthermore, I will argue that this proposal, together with the Phase Impenetrability Condition proposed by Chomsky (2000), explains a long-standing issue regarding a difference in boundedness between leftward and rightward movement to the effect that the former can apply successive cyclically, while the latter cannot.*

Keywords: linearization, the Linear Correspondence Axiom, the head parameter, the Phase Impenetrability Condition, boundedness of movement

1. Introduction

It has been widely assumed that human language has a movement operation to move an element from its canonical argument position to some other position. Take a direct object as an example. A direct object must appear immediately after a verb, as the contrast in (1) shows:¹

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¹ Following Postal (1974) and Lasnik and Saito (1991), I assume that the subject of an embedded infinitival in an exceptionally Case-marking (ECM) construction moves to a position in the matrix clause. In this sense, them in (1) is the direct object of the matrix verb expect. See section 5.1 for the relevant discussion.
(1) a. I never expected [them] to return so soon.
    b. *I never expected at all [them] to return so soon.

   (Stowell (1981: 189–190))

However, when the object is a wh-phrase, it appears in the sentence-initial position, which is its non-canonical position as in (2b):

(2) a. He expected [someone [who I was acquainted with]] to show up.
    b. [Who [who I was acquainted with]]$_1$ did he expect $t_1$ to show up?

   (Ross (1967: 21))

In addition to this non-canonical position, the relative clause in (2b) can appear in its non-canonical sentence-final position:

(3) [Who $t_2$]$_1$ did he expect $t_1$ to show up [who I was acquainted with]?$_2$

   (Ross (1967: 21))

Sentences like (2b) or (3) have been considered in generative treatments to be derived from (2a) by movement. Thus, the wh-phrase in (2b) has undergone leftward movement from the object position to the sentence-initial position. The relative clause in (3) has undergone rightward movement from within the sentence initial wh-phrase to the sentence-final position.

Notice that there is a crucial difference in boundedness between leftward and rightward movement: leftward movement can apply unboundedly, while rightward movement cannot. To illustrate this point, let us consider the following examples:

(4) a. What$_1$ did Bill buy $t_1$?
    b. What$_1$ did you force [Bill to buy $t_1$]?
    c. What$_1$ did Harry say [you had forced [Bill to buy $t_1$]]?

   (Ross (1967: 7))

(5) a. [A review [of this article]]$_1$ came out yesterday.
    b. [That [a review $t_1$] came out yesterday [of this article]]$_1$ is catastrophic.
    c. *[That [a review $t_1$] came out yesterday] is catastrophic [of this article]$_1$.

   (Ross (1967: 301, 305))

The sentences in (4) show that the wh-phrase what can move leftward from deeply embedded clauses, while the sentences in (5) show that the PP of this article fails to move rightward out of the clause in which it originates.²

In this paper, I propose to derive this difference in boundedness between

² This restriction on rightward movement has been attributed to a condition on transformations, referred to as the Right Roof Constraint (RRC). See Ross (1967) and Grosu (1973) for the relevant discussion.
leftward and rightward movement from the interaction of the ways to linearize syntactic objects in the derivational system within the framework of the Minimalist Program.

This paper is organized as follows. Section 2 will critically review some previous analyses of linearization. Section 3 will propose an alternative theory of linearization from the minimalist point of view. Section 4 will show that this proposal, together with the Phase Impenetrability Condition (PIC) proposed by Chomsky (2000), can account for the difference in boundedness previously mentioned. Section 5 will explore further consequences of the proposed analysis. Section 6 concludes this paper.

2. Theoretical Background

In this section, I go over the development of linearization within the framework of generative grammar. The earliest generative traditions in the 1950s and 1960s, including Chomsky (1965), assumed linear order to be determined by the combination of phrase structure rules and transformational rules. Phrase structure rules like (6) define linear order at deep structure:

\[
\begin{align*}
(6) & \quad \text{a. } S \rightarrow \text{NP Aux VP} \\
& \quad \text{b. } \text{VP} \rightarrow \text{V NP} \\
& \quad \text{c. } \text{NP} \rightarrow \text{DET N}
\end{align*}
\]

(6a) says that NP appears as the first element in the expansion of S followed by Aux and VP; (6b) states that V precedes NP in the expansions of VP; (6c) shows that NP is expanded into DET and N. The representations generated by these phrase structure rules are mapped onto the representations of surface structure by means of transformational operations, such as the Passive transformation in (7):

\[
(7) \quad \text{Passive Transformation} \\
\text{NP}_1 \text{ V NP}_2 \rightarrow \text{NP}_2 \text{ be V + en by NP}_1
\]

(7) states that NP$_1$ and NP$_2$ are inverted with a concurrent insertion of the passive morphemes V + en. To see this, consider the derivation of the following sentences:

\[
\begin{align*}
(8) & \quad \text{a. } \text{John stole the book.} \\
& \quad \text{b. } \text{The book was stolen by John.}
\end{align*}
\]

The sentences in (8) have the same deep structure in (9), which is generated by the phrase structure rules in (6):

\[
(9) \quad [S [NP \text{ John}] [VP \text{ stole} [NP \text{ the book}]]]
\]

Then, (8a) is derived by mapping this representation directly into the surface structure. On the other hand, (8b) is generated by the application of (7) as
shown in (10):

(10)  a. \( [S \ [NP_1 \text{John}] \ [VP \text{stole} \ [NP_2 \text{the book}]]] \)

↓ (7)

b. \( [S \ [NP_2 \text{The book}] \ [Aux \text{was}] \ [VP \text{stolen} \ [PP \text{by} \ [NP_1 \text{John}]]] \)

Based on these phrase structure and transformational rules, the earliest generative treatments tried to describe all and only the grammatical sequences of a given particular language. That is, the construction of descriptively adequate grammars was accelerated in this period.

However, since the late 1970s, the theoretical focus has changed to construct explanatorily adequate theories, which aim to eliminate the traditional concept of rules and constructions; instead, the effects are reduced to a set of universal principles and specific parameters (Chomsky (1981)). For example, the core properties of the phrase structure rules were encoded in terms of X’-theory (Chomsky (1970); Jackendoff (1977)) and a number of transformational rules were collapsed into a single movement transformation (Move α) (Chomsky and Lasnik (1977)).

This elimination of the phrase structure rules required a new procedure for linearization. The structural relations established by X’-theory argued that linear order is determined by means of directionality parameters such as the head parameter in (11) and the Spec parameter in (12) (see Stowell (1981); Travis (1984)):

(11) a. \( X' \rightarrow X \) Complement

b. \( X' \rightarrow \) Complement \( X \)

(12) a. \( XP \rightarrow \) Specifier \( X' \)

b. \( XP \rightarrow X' \) Specifier

The representations fixed by the head parameter in (11) place the head \( X \) either to the left or to the right of its subcategorized complement; the representations fixed by the Spec parameter in (12) determine the relative ordering of a specifier and its head. For instance, the head precedes its complement in a head-initial language, while the head follows its complement in a head-final language, which is a reflection of the head parameter in (11). This difference between these two language types can be illustrated by comparing the English example in (13a) with its Japanese counterpart in (13b):

(13) a. \( \text{John \ [vp went [pp to the store]]} \).

b. \( \text{Taroo-ga \ [vp \ [pp ano mise-e] \ it-ta].} \)

Taroo-Nom \ the\ store-to \ go-Past

‘Taroo went to the store.’

In (13a), the adposition \( \text{to} \) precedes its complement \( \text{the store} \). Likewise, the
verb went precedes its complement to the store. By contrast, the opposite ordering is found in (13b). The adposition e ‘to’ follows its complement ano mise ‘the store.’ Likewise, the verb it-ta ‘went’ follows its complement ano mise-e ‘to the store.’ These facts are explained on the assumption that English takes the option of (11a), while Japanese takes the option of (11b). With respect to the Spec-parameter in (12), English and Japanese choose the same Spec-initial option of (12a), so that the subjects (John and Taroo) precede the verb phrases in these two languages. In this way, the grammatical sequences of a language were taken to be determined in the principles-and-parameters approach by these directionality parameters.

However, it has been pointed out that this parametric approach to linear order runs into two kinds of problems. The first problem is that directionality parameters cannot account for why the Spec-initial option is at the core of human language. If the relation between phrase structure and linear order is parameterized in terms of the directionality parameters, we have four logically possible language types (see Kayne (1994); Takano (1996: 13)):

(14) a. Specifier-Head-Complement (Head-initial; Spec-initial)
   b. Specifier-Complement-Head (Head-final; Spec-initial)
   c. Head-Complement-Specifier (Head-initial; Spec-final)
   d. Complement-Head-Specifier (Head-final; Spec-final)

We have seen that (14a) is used in languages like English and (14b) in languages like Japanese. However, (14c) or (14d) is rarely found in natural languages. For example, VOS, OVS, and OSV are assumed to be “excessively rare” (see Greenberg (1966)). The relative ordering of a specifier and its head is much more visibly asymmetric: the specifier-head order strongly predominates. For this fact, the parametric approach does not assign any reason.

The second problem is that the directionality parameters cannot explain the fact that a preposition does not enter into an agreement relation with its complement as a postposition does. The parametric approach argues that the internal structure of a head-initial language and that of a head-final language have the same dominance and sisterhood relations. Thus, a prepositional phrase in (15a) and a postpositional phrase in (15b) should have the same internal structures, their difference being reduced to linear order:

(15) a. PP
    b. PP

We can see that (15a) is chosen by English, while (15b) is chosen by Japanese:
(16) a. John went \([_{PP} to the store]\).
    b. Taroo-ga \([_{PP} ano mise-e] it-ta\).
       Taroo-Nom the store-to go-Past
       ‘Taroo went to the store.’ (= (13))

However, these two options differ with respect to agreement possibilities: only the postposition exhibits inflectional agreement. Consider the following Hungarian examples:

(17) a. *mőgött-\textbf{em} én (P-DP order)
    behind-\textbf{Poss-1-sg.} I

b. én-mőgött-\textbf{em} (DP-P order)
    I-behind-\textbf{Poss-1-sg.}
    ‘behind me’ (Hornstein, Nunes and Grohmann (2005: 222))

The contrast in (17a) and (17b) shows that the head P manifests the agreement morphology only in the DP-P order. The P-DP order is acceptable only when the P does not exhibit any agreement morphology:

(18) a. át-\textbf{Ø} a hídon (P-DP order)
    over the bridge-Sup

b. *a hídon át-\textbf{Ø} (DP-P order)
    the bridge-Sup over
    ‘over the bridge’

(Hornstein, Nunes and Grohmann (2005: 222))

Hence, these examples strongly suggest that the agreement possibilities depend crucially on linear order. To the extent that the internal structure of a head-initial option is the same as that of a head-final option, the correlation between agreement possibilities and linear order is not predicted under the parametric approach.

To solve these problems in terms of the directionality parameter approach, Kayne (1994) seeks to eliminate the directionality parameters entirely by proposing the Linear Correspondence Axiom (LCA), which claims that a given phrase structure is mapped into a unique linear ordering on the basis of the asymmetric c-command relation. The relevant notions of asymmetric c-command and c-command are defined as in (19) and (20), respectively:

(19) X asymmetrically c-commands Y iff X c-commands Y and Y does not c-command X. \hspace{1em} (Kayne (1994: 4))

(20) X c-commands Y iff \textit{X and Y are categories} and Y excludes Y and every category that dominates X dominates Y. \hspace{1em} (Kayne (1994: 16))

Furthermore, Kayne (1994) presupposes the distinction between segment and category introduced by May (1985) and adopted by Chomsky (1986) as fol-
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lows:

(21) X excludes Y if no segment of X dominates Y.

(Chomsky (1986: 9))

Given these definitions, Kayne (1994) makes the following proposal: if a non-terminal X asymmetrically c-commands a non-terminal Y in a given phrase marker P, then all terminal elements dominated by X precede all terminal elements dominated by Y in P.

More concretely, let us take a closer look at the structure of (22a):

(22) a. John can speak Japanese.

b. 

As illustrated in (22b), NP1 asymmetrically c-commands T, VP, V, NP2, and N2; T asymmetrically c-commands V, NP2, and N2; V asymmetrically c-commands N2. Since a segment cannot enter into a c-command relation (May (1985)), the segment TP2 enters into no c-command relation. From these asymmetric c-command relations, we derive the following ordered pairs: <NP1, T>, <NP1, VP>, <NP1, V>, <NP1, NP2>, <NP1, N2>, <T, V>, <T, NP2>, <T, N2>, and <V, N2>. Hence, the linear order of the set of the terminal elements is John-can-speak-Japanese.

One consequence of the LCA is that there is a universal specifier-head-complement ordering. This is simply because the specifier asymmetrically c-commands the nodes dominating the head and the complement, and the head asymmetrically c-commands the nodes dominating the complement.

This takes on great significance in light of the specifier-initial predominance in human language. As discussed above, the directionality parameter approach fails to account for why the specifier precedes the head in almost all human languages. This fact is straightforwardly accounted for by the LCA: since the specifier asymmetrically c-commands the head, the specifier precedes the head.

Another consequence of the LCA is that right-adjunction is never permitted. For example, let us consider the derivation of the object-verb ordering in Japanese:
(23) Taroo-ga eigo-o hana-seru.
    Taroo-Nom English-Acc speak-can
    ‘Taroo can speak English.’

The LCA asserts that the underlying structure of (23) is the one in which the verb asymmetrically c-commands the direct object, so that the verb precedes the direct object. In order for the direct object to precede the verb, the direct object must asymmetrically c-command the verb. This requires the direct object to undergo leftward movement into the specifier position of some functional category (FP) as in (24):

(24)

This type of leftward movement allows the direct object to asymmetrically c-command the verb. Hence, the LCA correctly maps the resulting phrase structure of (24) into the object-verb ordering in (23). If we try to derive the object-verb ordering in (23) through the application of the rightward movement of the verb as in (25), a conflict occurs between precedence and c-command relations:

(25)

For the direct object to precede the verb, the direct object must asymmetrically c-command the verb. In (25), however, the verb has moved to occupy a structurally higher position than that of the direct object, so that the
verb asymmetrically c-commands the direct object. This results in a conflict between precedence and c-command relations. Hence, right-adjunction is inconsistent with the LCA-based approach.

This ban on right-adjunction in the LCA-based approach provides an answer to the problem with the strong correlation between linear order and agreement possibilities within the directionality parameter approach: the preposition does not manifest agreement as the postposition does:

\[(26)\]  
a. *mögött-em \text{én} \quad \text{(P-DP order)}  
\text{behind-Poss-1-sg. I}

b. \text{én-mögött-em} \quad \text{(DP-P order)}  
\text{I-behind-Poss-1-sg.}  
\text{‘behind me’} \quad (=\text{(17)})

The LCA-based approach claims that the P-DP order is an underlying head-complement structure of PP as in (27a), while the DP-P order is derived by the application of the leftward movement of the DP to the specifier position as in (27b):

\[(27)\]  
a. \begin{aligned}  
\text{PP}  
\text{P} &  
\text{DP} 
\end{aligned}

b. \begin{aligned}  
\text{PP}  
\text{DP}_1 &  
\text{DP} &  
\text{P}  
\end{aligned}  
\uparrow \quad \text{t}_1

It is generally assumed that agreement is obligatory in a specifier-head configuration but not in a head-complement configuration. To illustrate, consider the following examples:

\[(28)\]  
a. How many cookies are/*?is there on the table?  
b. There is/’s/are lots of cookies on the table.

(Schütze (1999: 468–469))

(28a) shows that the verb must agree with the plural DP \textit{how many cookies} in its specifier position. In (28b), on the other hand, the verb may manifest either a singular inflection or a plural inflection, showing that the verb does not have to agree with the DP in its complement position. Given this, the preposition in (26a) does not manifest agreement, because the internal structure of the PP has the head-complement configuration, while the postposition in (26b) must manifest agreement, because the internal structure of the PP has the specifier-head configuration. This is why the postposition alone manifests agreement. In this way, the LCA-based approach solves the two kinds of conceptual and empirical problems inherent in the directionality parameter approach.

However, there are at least two problems left with this LCA-based ap-
The first problem is that the LCA-based approach fails to explain why a complement moves leftward into the specifier position in a head-final language like Japanese. Consider the following examples (Takano (1996); Fukui and Takano (1998); Richards (2004)):

   Taroo-Nom English-Acc speak-can
   ‘Taroo can speak English.’

   (= (23))

   Taroo-Nom the store-to go-Past
   ‘Taroo went to the store.’

   (= (13b))

The complements of the verbs in (29a) and (29b) are DP and PP, respectively. These complements precede the head V. Under the LCA-based approach, all these complements move to the specifier position of some functional category. If they do not move, the LCA wrongly predicts that the complements should follow their heads. An immediate question arises as to the motivation for such a movement. In general, a movement operation in syntax applies only when a certain interface effect emerges (Chomsky (2001); Reinhart (2006)). Of course, it might be conceivable that the DP complement in (29a) moves to check its uninterpretable Case feature as some instruction to PF interface interpretation. However, the movement of the PP complement in (29b) would not have such an effect. Furthermore, the direct object in Japanese can appear without the overt Case marker (Saito (1983)):

   Taroo-Nom English speak-can
   ‘Taroo can speak English.’

Here, the direct object eigo ‘English’ manifests no Case marker, indicating that the accusative Case does not have to be assigned to the direct object in Japanese. If the object moves to the specifier position because of checking the uninterpretable Case feature, (30) shows that the direct object in Japanese may stay in its original position. That is, no leftward movement

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3 The reason why the direct object in Japanese does not move may have something to do with the function of the Case particle o. Miyagawa (1989) argues that this particle functions as exclamation or emphasis in Old Japanese, which is information useful for the interface interpretation. For the interface to interpret the information, verb phrases may undergo movement to a specifier position of the lower Focus Phrase in the sense of Belletti (2004). Thanks to an anonymous reviewer for suggesting this possibility.

4 See Ochi (2009) for the relevant argument with respect to overt object shift in Japanese.
of the complement at least in (29b) and (30) is motivated in syntax. If the object does not move at all, the LCA-based approach incorrectly predicts that the object should follow the verb.

The second problem is that the LCA-based approach fails to explain the interpretation of “stacked” adjuncts and their linear order. Let us consider the following examples (see Andrews (1983); Pesetsky (1989); Takano (2003)):

(31)  
\begin{align*}
 a. & \text{John knocked on the door [intentionally] [twice].} \\
 b. & \text{John knocked on the door [twice] [intentionally].}
\end{align*}

(Andrews (1983: 695))

Here, the preceding adjunct is in the scope of the following adjunct. In (31a), \textit{intentionally} is in the scope of \textit{twice}. The intended meaning is that \textit{John} gave the door two instances of intentional knocking. In (31b), \textit{twice} is in the scope of \textit{intentionally}. The intended meaning is that \textit{John} gave the door one intentional instance of knocking twice. Given that the scope relation is established by a c-command relation, the scope relation of the “stacked” adjuncts shows that the rightmost adjunct c-commands the leftmost adjunct to have wider scope. However, the LCA requires the rightmost adjunct to be asymmetrically c-commanded by the leftmost adjunct to have the linear order in (31). This is a paradox, which means that the LCA-based approach does not capture the interpretation of the “stacked” adjuncts and their linear order.

To summarize this section, I have examined the previous analyses of linearization and have demonstrated that several problems remain yet to be settled. In the next section, I will propose a new theory of linearization from the minimalist point of view and show that this proposal provides a solution to the remaining problems.

3. Proposal

Chomsky (1995) argues for the theory of bare phrase structure, in which syntactic structures are constructed by the operation \textit{Merge}. \textit{Merge} takes two syntactic objects and forms a new set-theoretically defined syntactic object. Chomsky (2004) goes on to divide \textit{Merge} into two subtypes: \textit{external Merge} and \textit{internal Merge}. \textit{External Merge} takes two separate objects ($\alpha$ and $\beta$) from Numeration and replaces them with the new combined syntactic object $K = \{\alpha, \beta\}$:
Internal Merge takes two syntactic objects as well. This merge is different from External Merge in that one of the objects is a subpart of the already constructed one:

\[(33) \quad \alpha \beta + \beta \rightarrow \alpha \beta \beta K\]

Here, K merges with β, which is a subpart of K. This merger operation constructs the new syntactic object \(L = \{\beta, K\}\). L includes two copies of β, one external to K, the other within K. Usually, the higher β is pronounced and the lower one is deleted. This process reflects a movement property of human language, which leads Chomsky (2004) to unify merge and movement under the general Merge operation. Recently, Chomsky (2007, 2008) attempts to identify the motivation of Merge and takes Merge to be an operation triggered by an edge feature (EF) on a lexical item. The lexical items consist of two subtypes: a phase head (C or \(v^*\)) and a non-phase head (T or V). Since both the phase and the non-phase heads have the EF, it follows that they both equally have the ability to trigger internal Merge as well as external Merge. I will adopt this assumption without specific argument.

Furthermore, Chomsky (2007, 2008) argues that the phase head plays a crucial role in constructing syntactic structures, whereby the phase head alone has those uninterpretable features which trigger the operation Agree. In addition, he hypothesizes that these uninterpretable features on the phase head are inherited by the head of its complement (see also Richards (2007)). Thus, the phase head C originally has uninterpretable \(\varphi\)-features and these features are derivationally inherited by the head of its complement T as in (34):

\[\varphi\text{-features}\]
After this inheritance, the uninterpretable φ-features on T enter into an Agree relation with the corresponding interpretable φ-features on a nominal in its c-command domain and raise this nominal to [Spec, TP]. To facilitate the discussion, consider the derivation of the following sentence:

(35) John loves Mary.

The relevant part of the sentence is derived in the following fashion:

(36)

First, as in (36a), the uninterpretable φ-features on C are inherited by T. Second, as in (36b), these inherited φ-features on T enter into an Agree relation with the matching interpretable φ-features on John in [Spec, v*P]. Contingent on this Agree, as in (36c), John moves into [Spec, TP]. Through these derivational steps, the sentence of (35) is generated.

Extending this framework further, Miyagawa (2010) proposes the Strong Uniformity hypothesis, which claims that “[a]ll languages share the same set of grammatical features, and every language overtly manifests these features” (p. 12). These grammatical features include the uninterpretable features originally on the phase head, so that Miyagawa’s proposal can be rephrased as follows: all languages share the same set of the phase heads and every language overtly manifests their roles. In other words, it is the phase head that has the ability to characterize universality of language. This implies that a non-phase head is obliged to have differences among particular languages. Therefore, Miyagawa’s proposal leads to the hypothesis that a phase head characterizes universality of language, whereas a non-phase head characterizes differences among particular languages.

In this paper, highlighting the distinction between a phase and a non-phase, on the one hand, and universality and differences among languages, on the other hand, I propose the following theory of linearization:

(37) Linear order within a phase domain (CP or v*P) is determined by the LCA, whereas linear order within a non-phase domain (TP or VP) is determined by the head parameter.
This proposal strongly supports the hypothesis mentioned above and claims that the linear order within the phase domain is universal among languages, because the LCA maps a given phrase structure into a unique linear ordering. On the other hand, the linear order within the non-phase domain is different among languages, because the head parameter produces a variation between head-initial and head-final options. Evidence for this claim will be provided below.6

Before presenting my analysis, a few words are in order about the proposal. First, to define “domain,” I adopt Chomsky’s (1995) definition of minimal domain given in (38):

\[
\text{(38) The minimal domain } \text{Min} (\delta(\text{CH})) \text{ of CH is the smallest subset } K \text{ of } \delta(\text{CH}) \text{ such that for any } \gamma \in \delta(\text{CH}), \text{ some } \beta \in K \text{ reflexively dominates } \gamma. \quad \text{(Chomsky (1995: 299))}
\]

Here, Min stands for a minimal domain; \(\delta\) is a domain; CH is a chain; K is the smallest subset of the minimal domain of the chain. The crucial point in (38) is that the minimal domain constitutes the set of nodes such as the complement, specifier, and adjuncts of a given head and defines the configurations that establish thematic, checking, or modification relations with projections of a head.

Second, I adopt Chomsky’s (1995) modified version of the LCA in the bare phrase structure theory, where the LCA is taken to be a condition on the phonological component. Relevant to my argument is that this modified version enables a given head to have multiple specifiers or adjuncts.

Third, I use the “head parameter” to specify the relation between the head and any other elements within the non-phase domain, including its complement and adjuncts.7 Specifically, I assume with Saito and Fukui (1998) that the effect of the head parameter is derived by the following mechanism of Merge:

\[\text{An anonymous reviewer raises the question of whether the present proposal counts as a departure from the Strong Minimalist Thesis (SMT), whereby language is an optimal solution to interface conditions, in that the present proposal adopts both the LCA and the head parameter. It might be that both of them are required independently by the interfaces. However, I know of no support for this idea as it stands, so that I will leave this issue for further research.}\]

\[\text{I assume that the non-phase head selects no specifier. The reason for this assumption is as follows: a specifier is an “escape hatch” created as a result of Agree. Agree is triggered by a phase head but not by a non-phase head. Therefore, the non-phase head cannot create specifiers.}\]
\[(39) \quad K = \{\gamma, <\alpha, \beta>\}, \text{ where } \gamma \in \{\alpha, \beta\}.\]

a. \(\gamma = \alpha\): head-initial, left-headed  
b. \(\gamma = \beta\): head-final, right-headed

(Saito and Fukui (1998: 452))

This indicates that \(\{\alpha, \beta\}\) created by Merge is replaced by an ordered pair \(<\alpha, \beta>\), specifying that the left element projects in a head-initial language or that the right one projects in a head-final language. That is, the asymmetry of the projection reflects the asymmetry of linear order (see also Kaneko (1999)). At this point, one might wonder when \(\{X, Y\}\) is replaced by \(<X, Y>\). Following Saito and Fukui (1998), Kaneko (1999) and Fukui (2001), I assume that this replacement takes place in overt syntax. 8

With these assumptions in mind, the present proposal of (37) can give a straightforward account of two kinds of problems left with the LCA. Let us take up the first problem with respect to the derivation of the complement-verb order in a head-final language like Japanese:

\[(40) \quad \begin{align*}
\text{a. Taroo-ga } [v_p [p_p \text{ ano mise-e}] \text{ it-ta].} \\
& \quad \text{Taroo-Nom the store-to go-Past} \\
& \quad \quad \text{‘Taroo went to the store.’}
\end{align*} \]

\[b. \quad \begin{align*}
\text{Taroo-ga } [v_p [d_p \text{ eigo-Ø}] \text{ hana-seru].} \\
& \quad \text{Taroo-Nom English speak-can} \\
& \quad \quad \text{‘Taroo can speak English.’}
\end{align*} \]

In (40a), the verb \textit{it-ta} ‘went’ merges with the PP \textit{ano mise-e} ‘to the store.’ In (40b), the verb \textit{hana-seru} ‘can speak’ merges with the non-Case marked direct object \textit{eigo} ‘English.’ The verb and its complement construct the non-phase category VP. The linear order within the non-phase domain is fixed by the head parameter. Since Japanese chooses the head-final option, the PP or the non-Case marked DP complement precedes the head V. For these reasons, the complement-head ordering in Japanese follows without any unmotivated leftward movement. 9

8 An anonymous reviewer points out that if the replacement takes place in overt syntax, the ordered pair would be sent to the conceptual-intentional (CI) systems, which are irrelevant to linear order. However, if this replacement takes place in PF, it is not clear how the distinction between the phase domain and the non-phase domain is detectable in overt syntax. In this paper, I tentatively assume that the replacement takes place in overt syntax. Incidentally, this does not say that the interpretation at the CI interface is based only on linear relations. It is intended that the information of linear relation as well as hierarchical relations is sent to the CI systems. Hence, the interpretation at the CI interface can be based on hierarchical relations, as is usually assumed.

9 In section 2, I have argued that the DP-P order in Hungarian is derived by the movement of the DP to [Spec, PP]. An anonymous reviewer poses the question of whether
Next, let us turn to the second problem with the interpretation of “stacked” adjuncts and their linear order, repeated here as in (41):

\[(41) \begin{align*}
  a. & \text{John knocked on the door [intentionally] [twice].} \\
  b. & \text{John knocked on the door [twice] [intentionally].} \quad (= 31) 
\end{align*} \]

The proposed analysis provides (41a) and (41b) with the relevant part of the structures in (42a) and (42b), respectively:

\[(42) \begin{align*}
  a. & \quad \text{VP}_3 \\
  b. & \quad \text{VP}_3 \\
  & \quad \text{VP}_2 \quad \text{AdvP}_2 \\
  & \quad \text{VP}_1 \quad \text{AdvP}_1 \quad \text{twice} \\
  & \quad \text{knocked on the door} \quad \text{intentionally} \\
  & \quad \text{twice} \quad \text{the door} \\
  & \quad \text{intentionally} \quad \text{knocked on} \\
\end{align*} \]

These structures are derived as follows: first, the non-phase category \( \text{VP}_1 \) merges with \( \text{AdvP}_1 \). Our replacement mechanism of Merge with linear order forces \( \text{VP}_1 \) to precede \( \text{AdvP}_1 \) because \( \text{VP}_1 \) projects to construct \( \text{VP}_2 \). Similarly, \( \text{VP}_2 \) merges with \( \text{AdvP}_2 \) and projects to construct \( \text{VP}_3 \), so that \( \text{VP}_2 \) precedes \( \text{AdvP}_2 \). Hence, the ordering in (41) follows. With respect to the scope relation between the “stacked” adjuncts, the rightmost adjunct c-commands the leftmost adjunct, so that the rightmost adjunct scopes over the leftmost one. Therefore, the proposed analysis explains the interpretation of the “stacked” adjuncts and their linear order.

Notice, here, that “stacked” adverbs can appear in front of a verb (see also Jackendoff (1972)):

\[(43) \begin{align*}
  a. & \text{John [twice] [intentionally] knocked on the door.} \\
  b. & \text{John [intentionally] [twice] knocked on the door.} \\
\end{align*} \quad \text{Andrews (1983: 696)}
\]

In these cases, the preceding adjunct takes scope over the following one. The proposed analysis claims that this type of adverb occupies the adjoined position of the phase head \( v^\ast \) as in (44):

\[(44) \begin{align*}
  a. & \text{John [} v^\ast \text{p twice [} v^\ast \text{p intentionally [VP knocked on the door]]]} \\
  b. & \text{John [} v^\ast \text{p intentionally [} v^\ast \text{p twice [VP knocked on the door]]]} \\
\end{align*} \]

the complement-verb order in (40) is derived via leftward movement of the complement to the specifier position. The crucial difference between Hungarian and Japanese is that Hungarian has an agreement system but Japanese lacks such a system (Fukui (1986); Kuroda (1988)). Given that movement to the specifier position is contingent on some agreement, I assume that Japanese cannot take the movement option to derive the linear order in (40).
Since the linear order within the phase domain is determined by the LCA, the leftmost adjunct asymmetrically c-commands and precedes the rightmost one. Likewise, since the scope relation is determined by a c-command relation, the preceding adjunct takes scope over the following one.\(^{10}\)

As an anonymous reviewer points out, there is also another case where one adjunct precedes the verb, while the other follows the verb as in (45):

(45) a. John [intentionally] knocked on the door [twice].
   b. John [twice] knocked on the door [intentionally].
   
   (Andrews (1983: 696))

These sentences are ambiguous: *intentionally* can scope over *twice*, and vice versa. Let us take a closer look at the internal structure of (45a). The proposed analysis assigns to this example the following two types of structures given in (46).

(46) a. John \[v_P \text{ intentionally} [v_P \text{ knocked on the door} \text{ twice}]\].
   b. John \[x_P [v_P \text{ intentionally} [v_P \text{ knocked on the door} \text{ twice}]\].

In (46a), *intentionally* has left-adjoined to the phase \(v^*_P\), whereas *twice* has right-adjoined to the non-phase VP. Since *intentionally* c-commands *twice*, the former takes scope over the latter. In (46b), *intentionally* has left-adjoined to \(v^*_P\), whereas *twice* has right-adjoined to the non-phase XP dominating \(v^*_P\) as its complement. Then, *twice* c-commands and scopes over *intentionally*. From these two types of internal structures, the ambiguous scope relations in (45) follow.

Relevant to this kind of discussion about the internal structure of verb phrases, another reviewer raises the question of how the proposed analysis deals with a sentence containing a three-place predicate as in (47):

(47) John put [the book] [on the table].

The present analysis gives the following internal structure of the verb phrase:

(48) John \(_1 [v_P t_1 \text{ put}_2 [v_P \text{ the book} t_2 [v_P t_2 \text{ on the table}]])\].

In (48), the verb phrase has the three-layer structure: \(v^*_P\), YP, and VP. The

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\(^{10}\) Yoshiaki Kaneko (personal communication) has questioned whether there is a difference in interpretation between the verb-adverb order as in (41) and the adverb-verb order as in (43). If the difference exists, it may have something to do with the difference in interpretation between the noun-adjective order in (ia) and the adjective-noun order in (ib):

(i) a. stars visible
   b. visible stars

In (ia), the postnominal adjective denotes temporal states. In (ib), the prenominal adjective denotes permanent states. I will leave this question for further research.
former two are the phases and the last is the non-phase. Since the phase has the specifier on its left side, *John* merges with [Spec, v*P] (and then moves to [Spec, TP]) and *the book* merges with [Spec, YP]. On the other hand, the non-phase head *V* in English takes its complement on the right side, so that *on the table* appears in this complement position. In addition, the verb *put* undergoes head movement from *V* to *v* through *Y* (see section 5.1). Then, the linear order in (48) is derived. In short, to the extent that the present proposal is on the right track, the possibility emerges that the internal structure of the verb phrase comprises a rich number of projections. For reasons of space, I will leave a close examination of this possibility for further research.

In summary, the proposed analysis solves the two kinds of empirical problems left with the LCA-based approach and predicts exactly the right linear order.

In addition, the present proposal suggests a new perspective to classify human language into two types in terms of linear order. The important point is that the linear order within the non-phase is established by the head parameter, which divides languages into two types based on the way that the head precedes its complement and adjunct in a head-initial language or the head follows them in a head-final language. Two representative languages of these types are English and German. Look at the examples in (49):

\[(49)\begin{align*}
\text{a. } & \text{I knew [CP that [TP the student had [VP bought the book]]].} \\
\text{b. } & \text{Ich weiß, [CP daß [TP der Student [VP das Buch gekauft] hat]].}
\end{align*}\]

I know that the student the book bought has

‘I know that the student has bought the book.’

The English example in (49a) is the same as the German example in (49b) in that the phase head *C* precedes *TP*, which is because the linear order within the phase domain is universally determined by the LCA. However, these languages differ in that the non-phase head *V* precedes its complement in English, while *V* follows it in German. The same argument can be extended to the following examples, having to do with the linear order between the verb phrase and its adjunct:

\[(50)\begin{align*}
\text{a. } & \text{They have [VP (*frugally) lived (frugally)].} \\
\end{align*}\]

The present analysis might wrongly predict that *frugally* can precede the verb if it occupies the adjoined position of *v*.* However, as an anonymous reviewer suggests, adverb phrases may have their positions in the universally determined hierarchical structure in the sense of Cinque (1999). I adopt this suggestion and assume that *frugally* has its position within the VP domain.
b. Sie haben [\textit{VP} (\textit{genügsam}) ge]lebt (*\textit{genügsam})].\textsuperscript{12} 
\textit{they have frugally lived frugally} 
‘They have lived frugally.’ (Haider (2000: 55))

The contrast in (50) shows that the VP-adverb must follow V in English but precede V in German. That is, the present proposal argues that the difference in linear order among particular languages should be reduced to the relative position of the non-phase head and its complement/adjunct.\textsuperscript{13}

To summarize the discussion thus far, I have shown that the present analysis solves all of the problems with the previous analyses and, furthermore, divides human languages into two types in terms of linear order. In the next section, I will show that the present proposal, together with the PIC proposed by Chomsky (2000), explains the long-standing issue regarding boundedness between leftward and rightward movement in English.

4. The Difference in Boundedness between Leftward and Rightward Movement

Chomsky (2000) proposes the phase theory, in which all of the syntactic operations apply phase-by-phase. Once a phase is completed, Transfer/Spell-Out takes place. The complement of the phase head is sent to interpretation at the PF and LF interfaces, only the phase head and its edge being accessible to subsequent operations. This condition is defined as the PIC. I assume that the phase is completed when the phase merges with a head that selects the phase as its complement. Thus, \textit{v}\textsuperscript{*}P is completed when this \textit{v}\textsuperscript{*}P merges with T and the embedded CP is completed when this CP merges with the matrix verb V. Given this system of syntactic computation, the following subsections will account for why leftward movement can apply unboundedly, while rightward movement cannot in English.

\textsuperscript{12} Haider (2000) does not provide the concrete contrastive examples of (50b). However, my informant said to me that the clear contrast in grammaticality exists between the adverb-verb order and the verb-adverb order.

\textsuperscript{13} The difference in linear order may be observed among categories in a language as well. For example, Haider (2004) suggests that German clausal non-phase categories choose the head-final option but nominal non-phase categories choose the head-initial option. On the other hand, Travis (1984) suggests that Chinese clausal non-phase categories choose the head-initial option but nominal non-phase categories choose the head-final option.
4.1. Leftward Movement

To begin with, let us discuss the derivation involving leftward movement. The present proposal argues that the linear order within a phase domain is determined by the LCA, which places a specifier on the left side of its head. The specifier is a typical target position for a moved element. This implies that when movement applies within the phase domain, leftward movement applies. Since movement is triggered by the EF, leftward movement is triggered by the EF on the phase head (C or v*):

\[(51)\]

As seen in (51), the landing site of the moved element XP is outside the inaccessible Spell-Out domain and, therefore, we predict that leftward movement should be able to apply successively cyclically. This prediction is borne out by the following sentences:

\[(52)\]

Here, the wh-phrase what moves leftward from the object position to the sentence-initial position. (52b, c) show that the leftward movement of the wh-phrase what applies across the Spell-Out domains, providing strong evidence for the argument that leftward movement applies successively cyclically.

We have to specify whether the landing site of wh-movement is actually the left edge of the phase. This assumption is supported by Condition A of the binding theory.\(^{14}\) First, let us discuss the position of [Spec, CP]. Consider the following example:

\[(53)\]

In (53), himself is bound by he. This interpretation of himself is possible if the wh-phrase has passed through the embedded [Spec, CP] position \(t_2'\). Hence, examples like (53) support the argument that the wh-phrase

\(^{14}\) See McCloskey (2000) and Sato (2008) for other types of argument that the landing site of leftward movement is the specifier of the phase.
has moved to the [Spec, CP] position.

Next, let us turn to the position of [Spec, v*P]. Look at the following sentence:

(54) [Which picture of himself$_1$]$_2$ does John$_1$ $t_2'$ expect Mary to buy $t_2$? (Hornstein, Nunes and Grohmann (2005: 361))

(54) is an ECM construction, which implies that the embedded clause does not have a CP layer. In order for himself to be bound by John, the wh-phrase has moved through the position below John but above Mary. If there is a copy of the wh-phrase in the matrix [Spec, v*P] position ($t_2'$), himself can be bound by John. In this view, (54) is an example, showing that the wh-phrase has moved to the [Spec, v*P] position.

Therefore, it is clear from these empirical arguments that leftward movement is triggered by the EF on the phase head, subject to the LCA, and applies unboundedly through the left edge of the phase.

4.2. Rightward Movement

Next, let us move on to examine the derivation involving rightward movement. The present proposal claims that the linear order within a non-phase domain is determined by the head parameter. In English, a head-initial language, the head parameter requires a head to be followed by any other element within the domain. Thus, when an element undergoes movement triggered by the EF on a non-phase head (T or V), the landing site of the movement is the right edge of the non-phase (TP or VP):

\[
\begin{align*}
4.2. & \quad \text{Rightward Movement} \\
& \text{Next, let us move on to examine the derivation involving rightward movement. The present proposal claims that the linear order within a non-phase domain is determined by the head parameter. In English, a head-initial language, the head parameter requires a head to be followed by any other element within the domain. Thus, when an element undergoes movement triggered by the EF on a non-phase head (T or V), the landing site of the movement is the right edge of the non-phase (TP or VP):}
\end{align*}
\]
At this stage, one might think that the EF on the phase head could trigger leftward movement of the rightward moved XP to its specifier position. However, it could not. I assume that, after an XP undergoes rightward movement, the application of leftward movement leads to ungrammatical output. Leftward and rightward movement should have distinct effects at the interface levels, including a difference between old and new information. If an element moves leftward after it moves rightward, the interface levels have to interpret the contradicting information. To avoid this, if the interface levels would interpret the information only about leftward movement, the rightward movement would count as an unnecessary operation in syntax. This type of non-economical operation should be eliminated under the minimalist point of view. Therefore, I assume such an application of “improper” movement to be impossible. In view of this, XP cannot be a target for the EF on the phase head. No operation applies to XP at this stage of derivation. Then, the derivation proceeds and reaches the point where the phase is completed and Transfer takes place:

(57)

At this stage, XP in the right-adjoined position of TP or VP fails to be a target for the EF outside the phase, because XP is inside the Spell-Out domain (the bold-faced domain). In short, the present analysis predicts that once an element undergoes rightward movement, it cannot undergo any other operation.

I show that this prediction is borne out on the basis of extraposition.15 To start with, let us consider extraposition from the object in (58):

(58)  

a. John calls people [whom he has never met before] up.  

b. John calls people up [whom he has never met before].  

(Baltin (1981: 267))

Here and in what follows, the bold-faced element represents the head noun phrase and the bold-faced brackets the extraposed phrase. In (58a), the relative clause is adjacent to its antecedent. In (58b), the particle up inter-

15 Following Drummond (2009), I take extraposition as a syntactic operation.
posed between them, showing the application of extraposition of the relative clause from the direct object position. The derivation of this sentence goes as follows:

(59)

First, the direct object DP merges with the non-phase head V to construct VP

Second, the EF on V triggers the extraposition of the relative clause XP from within the object into the right edge of VP to construct VP

Then, VP constitutes the Spell-Out domain when v*P is completed. Since the relative clause has moved to occupy the right edge of the spelled-out VP, it is predicted that it can no longer move out of VP.

That the landing site of the relative clause extraposed from the object is the right edge of VP is supported by verb phrase ellipsis. Merchant (2008) proposes that the target of the verb phrase ellipsis is not v*P but VP on the basis of the following example:

(60) This problem was to have been looked into, but obviously nobody did. (Merchant (2008: 169))

Ellipsis requires that an elided element have the syntactically and semantically identical antecedent. The grammaticality of (60) indicates that the elided material in the second conjunct is identical to the VP in the first conjunct. In fact, before passivization applies, *this problem in the first conjunct occupies the object position of the verb:

(61) This problem was to have been [VP looked into this problem], but obviously nobody did [VP look into this problem].

In this case, the VP in the first conjunct is identical to that in the second conjunct, so that ellipsis applies to the corresponding VP in the second conjunct. On the basis of this discussion, Merchant (2008) assumes that the verb phrase ellipsis targets VP. With this assumption in mind, let us consider the following sentences:

(62) a. John calls *people up [whom he has never met before], and Bill does.

b. *John calls people up [whom he has never met before], and Bill does [whom he has met only briefly].

(Baltin (1981: 292, fn. 3))
The contrast in grammaticality clearly shows that the sentence is acceptable only when the relative clause extraposed from the object is deleted along with VP. Hence, the claim that the landing site of the relative clause extraposed from the object is the right edge of VP is supported.

Furthermore, a closer examination of the derivation of the following sentences reveals that the extraposed phrase from the object fails to move out of the VP where it originates. Consider the following sentences:

(63) a. [That Sam didn’t pick those packages up [which are to be mailed tomorrow]] is possible.

b. *[That Sam didn’t pick those packages up] is possible [which are to be mailed tomorrow]. (Ross (1967: 284–285))

The relative clause in (63a) has undergone extraposition from the object into the right edge of the VP in which it originates. This sentence is grammatical, because the relative clause is still visible to the EF on the V. On the other hand, the relative clause in (63b) has undergone extraposition from the object into the right edge of the matrix VP, and this sentence is ungrammatical. This is just because the relative clause has already been spelled-out and is invisible to the EF on the matrix V. Therefore, the contrast demonstrates that extraposition from the object applies only within the Spell-Out domain where the object is introduced.

Next, let us consider extraposition from the subject in (64):¹⁶

(64) a. A man entered the room [who wasn’t wearing any clothes].

b. A man just bought that restaurant [who everyone says is an entrepreneur]. (Rochemont and Culicover (1990: 67))

These sentences are derived as follows: first, the subject externally merges in [Spec, v*P]. Second, the EF on T triggers the extraposition of the relative clause from the subject to the right edge of TP. Third, TP merges with C. Then, CP is completed and TP is inaccessible to further syntactic operations. Therefore, the present proposal predicts that the relative clause extraposed from the subject can no longer move out of TP.

When the VP-ellipsis applies, the relative clause extraposed from the subject is not deleted along with VP:

(65) Although not many people would ride with Fred [who knew just him], some would [who knew his brother]. (Baltin (2006: 241))

This shows that the landing site of extraposition from the subject is not the

¹⁶ Some researchers have argued that extraposition from the subject is impossible when the verb is transitive (Johnson (1985)). However, I assume with Rochemont and Culicover (1990) that such extraposition is possible.
right edge of VP but the right edge of TP.

Furthermore, the following sentences indicate that the relative clause extraposed from the subject cannot move out of the TP where it originates:

(66) a. John believes [CP that a man was here [who comes from Philadelphia]] despite the evidence to the contrary.

b. *John believes [CP that a man was here] despite the evidence to the contrary [who comes from Philadelphia].

(Chomsky (1973: 271))

In (66a), the relative clause has moved from the embedded subject to the right edge of the embedded TP. This is possible because the relative clause is still accessible to the EF on the embedded T. In contrast, (66b) is not derived, because the relative clause has already been spelled-out and is inaccessible to the EF on the matrix T. Hence, the relative clause extraposed from the subject can move only to the right edge of the TP where it merges. In this way, the present analysis can give a straightforward account of the boundedness of rightward movement.

To summarize, all types of evidence in this section support the proposed analysis, whereby leftward movement is triggered by the EF on the phase head, subject to the LCA, and it can apply successive cyclically, whereas rightward movement is triggered by the EF on the non-phase head, conforming to the head parameter, and it fails to apply successive cyclically. Therefore, the difference in boundedness between leftward and rightward movement follows from the proposed analysis.

5. Further Consequences

In this section, I explore further consequences of the present analysis. In subsection 5.1, I discuss an apparent problem in terms of leftward movement to the specifier position of the non-phase, and show that this is not actually a problem. In subsection 5.2, I argue that the prepositional phrase is immediately dominated by a phase. In subsection 5.3, I discuss the implications of the present analysis for Japanese syntax.

5.1. Leftward Movement to the Specifier of the Non-Phase

The present analysis has argued that leftward movement applies within the phase domain, subject to the LCA. Within the non-phase domain, on the other hand, rightward movement applies in English, conforming to the head-initial option of the head parameter. However, it is widely acknowledged that the non-phase head T manifests the inflectional feature agreement
and raises a nominal to its specifier position. To illustrate this, consider the following examples:

(67) a. John was/*were arrested (by the police).
   b. John and Mary *was/were arrested (by the police).

The sentences in (67) show that T must manifest the inflectional agreement with the subject DP. In addition to this agreement, the DP has moved to occupy [Spec, TP]. That is, the non-phase head T triggers leftward movement as well as agreement. Since the present analysis claims that T has the EF triggering rightward movement, it wrongly predicts that such leftward movement to [Spec, TP] should be ruled out.

This problem can be solved by adopting Chomsky’s (2007, 2008) feature inheritance mechanism (see section 3), whereby the phase head originally has the uninterpretable φ-features and these features are derivationally inherited by the head of its complement. Specifically, T inherits the uninterpretable φ-features from C. When C is introduced in syntactic computation, the derivational stage is where linear order is determined by means of the LCA, which forces leftward movement to apply. This means that when T inherits the φ-features from C, this T has the ability to trigger leftward movement. Therefore, leftward movement to [Spec, TP] applies.

As an anonymous reviewer points out, this inheritance mechanism can be extended to the v*-V relation as well: v* transmits its uninterpretable φ-features to V. After this inheritance, the uninterpretable φ-features on V raise the agreeing DP to [Spec, VP], yielding the “raising to object” configuration that obtains with ECM cases as in (68):

(68) John believed [Mary] to be smart.

This sentence is derived as follows: first, the uninterpretable φ-features on the matrix v* are inherited by the head of its complement V. Second, these features on V trigger leftward movement of the embedded subject Mary to [Spec, VP] in the matrix clause, conforming to the LCA. Then, the ordering in (68) is derived. Therefore, if the uninterpretable feature is inherited from the phase head, the non-phase head can trigger leftward movement. 17

Note, however, that the operation in the ECM construction seems to make

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17 Etsuro Shima (personal communication) points out to me that if the EF on the phase head is inherited by T, this EF should be able to trigger “leftward” extraposition to [Spec, TP]. However, this prediction is not borne out:

(i) a. A man [who was from Philadelphia] came in.
   b. A man came in [who was from Philadelphia].
   c. *[Who was from Philadelphia] a man came in. (Baltin (1978b: 20, 22))

I will leave this problem as it stands.
no sense in that the leftward movement to [Spec, VP] has no visible effect, since V raises to v* (see Chomsky (2007: 21, 2008: 148)). Moreover, if V always moves to v*, one might argue that the verb-object order in English, a motivation for the head parameter in this paper, may have nothing to do with the head parameter; instead, its order follows from the LCA, since the phase head v* asymmetrically c-commands [Spec, VP]. This may be the case. However, I still claim that the discussion about the derivation of the complement-verb order in a head-final language (section 3), the interpretation of “stacked” adjuncts and their linear order (section 3), and the landing site of extraposition (section 4) are crucial for the argument that the linear order within the non-phase is determined by the head parameter.

5.2. Prepositional Phrases as Phases

In this section, I explore the possibility of phasehood of prepositional phrases in English. Let us consider the sentences in (69):

(69) a. [In which magazine [which was lying on the table]] did you see it t₁?

b. Which magazine₁ did you see it [in t₁ [which was lying on the table]]?¹⁸

c. *[In which magazine] did you see it [which was lying on the table]? (Baltin (1978a: 34))

(69a) shows that the whole PP can undergo wh-movement to the sentence-initial position; (69b) shows that only the wh-phrase within PP can move leftward out of the PP; (69c) shows that the relative clause modifying the wh-phrase within PP cannot move rightward out of the PP. Furthermore, look at the following sentences:

(70) a. Pictures of several people are for sale [which I like].

b. *Pictures of several people are for sale [who I like].

(Chomsky (1981: 80))

In (70a), the relative clause modifying the subject has undergone extraposition. In (70b), on the other hand, the relative clause modifying the complement of the P of within the subject has undergone extraposition. The contrast in grammaticality between (70a) and (70b) indicates that extraposition does not apply to the complement of P.

The descriptive generalization from the data is that the complement of P does not undergo rightward movement out of PP. This generalization fol-

¹⁸ Baltin (2006) gives this sentence two question marks. However, he points out that a contrast in grammaticality exists between (69b) and (69c).
allows if PP is immediately dominated by a certain phase head F. Since the Spell-Out domain is inaccessible to operations outside the phase, any element within the complement of the phase head, namely PP, is inaccessible as illustrated in (71):

(71)

Therefore, we assume, as a consequence of the proposed analysis, that PP is immediately dominated by a phase. 19

5.3. Implications for Japanese Syntax

Finally, this section discusses the implications of the present analysis for Japanese syntax. To begin with, let us consider the phrase structure in Japanese. I have proposed that linear order within the phase domain is determined by the LCA, whereby the head precedes its complement. If Japanese has a series of phase heads, these heads should precede their complements as in (72):

(72)

However, all of the overt heads follow their complements in Japanese:

19 Masaru Nakamura (personal communication) suggests a possibility that there are two types of PP: one is dominated by a phase and the other is not. This possibility may be confirmed. It has been argued that an adjunct PP constitutes an opaque domain for binding and extraction, while an argument PP does not:

(i) a. ?? John left Mary [behind himself].
(ii) a. *Who1 did John leave Mary [behind t1]?
    b. Who1 did John put [behind t1]? (Hestvik (1991: 466))

Therefore, the adjunct PP may be dominated by a phase, whereas the argument PP may not.
(73) Hanako-wa [Taroo-ga eigo-o hana-seru to] omotte-iru. Hanako-Top Taroo-Nom English-Acc speak-can that think-Pres ‘Hanako thinks that Taroo can speak English.’

To account for this fact, I assume that the phase heads are non-overt elements in Japanese. Given this assumption, the internal structure of (73) is the following:

(74)

Let us assume here Fukui’s (1986) argument that to ‘that’ is a postposition. As discussed in section 5.2, PP is immediately dominated by the phase FP. Thus, the phase heads in (74) are C, v*, and F, which are occupied by the non-overt elements. In contrast, the non-phase heads, T, V, and P, are occupied by the overt elements. From this structure, the linear ordering in (73) follows. Accordingly, to the extent that the present analysis is correct, it follows that the phase heads are non-overt elements in Japanese.

Next, I would like to examine extraposition in Japanese. As discussed in section 4.2, English has “rightward” extraposition as one of the consequences of the head-initial option. The present analysis argues that Japanese chooses the head-final option, which leads us to expect that if extraposition applies in Japanese, the extraposed phrase must precede the head as in (75):
This means that, contrary to English, Japanese should have “leftward” extraposition. This expectation is realized. Let us consider the following examples:

‘Hanako heard the rumor that Taroo stole the book.’

b. [Taroo-ga hon-o nusun-da toiu] Hanako-wa Taroo-Nom book-Acc steal-Past that Hanako-Top
uwasa-o kii-ta.
rumor-Acc hear-Past
‘lit. That Taroo stole the book Hanako heard the rumor.’

steal-Past that
‘lit. Hanako heard the rumor that Taroo stole the book.’

Here, the object is modified by the appositive clause. The contrast between (76b) and (76c) shows that the appositive clause can only undergo “leftward” extraposition.21 This type of leftward movement is different from

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20 As Yosuke Sato (personal communication) and an anonymous reviewer point out, this sentence is possible when it is interpreted as a right dislocated element or as a hanging topic (see Endo (2007: 106–107) for the relevant discussion). I tentatively assume that such constructions are derived by applying successive leftward movement.

21 The relative clause in Japanese fails to undergo “leftward” extraposition:

‘Taroo stole the book that Hanako read.’

‘lit. That Hanako read Taroo stole the book.’

I assume that the ungrammaticality of (ib) is attributed to the internal structure of relative clauses in Japanese. Murasugi (1991) argues that Japanese relative clauses are TPs. TP
scrambling in that the movement in (76b) strands the head noun phrase in its original position, while scrambling in (77) pied-pipes the entire noun phrase:

(77) [Sono kookana hon-o]₁ Taroo-ga t₁ nusun-da.
the expensive book-Acc Taroo-Nom steal-Past
‘lit. The expensive book Taroo stole.’

Next, let us go on to consider extraposition from the subject. In this case as well, the appositive clause undergoes only leftward movement:

uwasa-ga hiromat-ta.
rumor-Nom spread-Past
‘Yesterday, the rumor that Taroo stole the book spread.’
b. [Taroo-ga hon-o nusun-da toiu] kinoo Taroo-Nom book-Acc steal-Past that yesterday
uwasa-ga hiromat-ta.
rumor-Nom spread-Past
‘lit. That Taroo stole the book yesterday the rumor spread.’
steal-Past that
‘lit. Yesterday, the rumor spread that Taroo stole the book.’

Therefore, these data support the argument that Japanese has “leftward” extraposition.

Notice, furthermore, that this type of movement may apply successive cyclically:

(79) a. Yamada sensei-wa [Taroo-ga [siken-o ukeru toiu] Professor Yamada-Top Taroo-Nom test-Acc take-Pres that
ketui-o katame-ta to] kii-ta.
determination-Acc confirm-Past that hear-Past
‘lit. Professor Yamada heard that Taroo confirmed his determination to take the test.’
b. [Siken-o ukeru toiu] Yamada sensei-wa [Taroo-ga test-Acc take-Pres that Professor Yamada-Top Taroo-Nom
ketui-o katame-ta to] kii-ta.
determination-Acc confirm-Past that heard-Past

is generally taken as a non-extractable phrase (see Rizzi (1982); Chomsky (2001: 6)). This is why the relative clause in (ib) cannot undergo movement.
‘lit. To take the test Professor Yamada heard that Taroo confirmed his determination.’

The grammaticality of (79b) strongly suggests that Japanese “leftward” extraposition may apply unboundedly. This is possible because the application of leftward movement after the application of leftward movement lead to “proper” movement (see section 4). In Japanese, the EF on the non-phase head triggers leftward movement, conforming to the head-final option of the head parameter. Similarly, the EF on the covert phase head triggers leftward movement, subject to the LCA. Thus, after an element undergoes movement triggered by the EF on the non-phase head, this element can be a target of the EF on the phase head. In addition, an anonymous reviewer points out that if this “leftward” extraposition in Japanese corresponds to leftward movement in English in the sense that they apply unboundedly, it is predicted that an anaphoric expression within an appositive clause extraposed from the embedded object can be bound by its antecedent in the matrix subject position (see (53) and (54)). This prediction seems to be borne out by the following sentence:

(80) [Zibunzisin1-no gakoo-de siken-o ukeru toiu] himself-Gen school-in test-Acc pass-Pres that
Yamada sensei-wa [Taroo1-ga ketui-o Professor Yamada-Top Taroo-Nom determination-Acc
katame-ta to] kii-ta.
confirm-Past that heard-Past
‘lit. To take the test in his school Professor Yamada heard that Taroo confirmed his determination.’

Therefore, I conclude that Japanese has “leftward” extraposition and this extraposition can apply successive cyclically.

6. Conclusion

In this paper, I have proposed that the linear order within the phase domain is determined by the LCA, whereas the linear order within the non-phase domain is determined by the head parameter. I have shown that this proposal accounts for the problems with the previous analyses of linearization and suggests a new perspective to classify human language into two types in terms of linear order. Furthermore, I have demonstrated that the proposed analysis, together with the PIC, explains the long-standing issue regarding the difference in boundedness between leftward and rightward movement to the effect that leftward movement can apply successive cy-
clically, while rightward movement fails to apply across the Spell-Out domain. As a consequence of the present analysis, I have also argued that the present proposal supports the mechanism of feature inheritance advocated by Chomsky (2007, 2008), that the prepositional phrase is immediately dominated by a phase, that the phase head is covert in Japanese, and that Japanese has “leftward” extraposition.

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