Cartography Meets Labeling Algorithm

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ABSTRACT. In this paper, following Chomsky (2013, 2015), I indicate how Labeling Algorithm (LA) applies to topicalization and focalization, which are phenomena of the left periphery in sentences. In particular, following Rizzi's (2004) typology of features, I propose a method of label determination with focalization and topicalization; in focalization, the focus element has a Q feature, and feature sharing (FS) occurs between the focus element and a C head while topicalization has an unlabeled structure {XP, YP}.[*]

Keywords: Cartography, Labeling Algorithm, Topicalization, Focalization, Root Phenomena

1. Introduction

In recent studies on minimalism, Chomsky et al. (2019) notes that it is difficult to deal with the structure of hierarchical functional projections assumed by *Cartography* (Rizzi 1997, 2004). Under *Free Merge* (Chomsky 2013, 2015), syntactic features do not trigger syntactic movement and "projection" is separated from Merge. "Projection" is derived from *Labeling Algorithm* (LA), which determines *Labels* of syntactic objects constructed by Merge (we will see the details of LA in section 2). In Cartography, also, discourse-related features like topic, focus, etc. are introduced, but these are not inherent to lexical items and are barred by the *Inclusiveness Condition* (IC), which precludes the introduction of extraneous features in the syntactic derivation. The trigger property of syntactic features, functional projections of these features, and the introduction of these features, are essential parts of Cartography because it assumes discourse-related features act as triggers of movement into the specifier of functional projections whose head are these features. However, these essential properties are abandoned under Free Merge.

In this paper, I examine how LA is applied to phenomena of the left periphery in sentences such as topicalization and focalization, which are often focused on in Cartography.

These constructions are not dealt with in Chomsky (2013, 2015).   In Section 2, I review the LA proposed by Chomsky (2013, 2015).   In Section 3, I propose the application of LA to topicalization and focalization.   In section 4, I show my proposal asymmetries between topicalization and focalization.   Section 5 concludes the paper.

2. Labeling Algorithm (LA)

Chomsky (2013, 2015) argues that syntactic objects (SOs) constructed by Merge must have labels to be interpreted at both the *Conceptual-Intentional* (C-I) interface and the *Sensorimotor* (SM) interface, but the operation Merge just combines two SOs and forms a set of them, so Merge cannot determine labels of SOs.   In Chomsky (2013, 2015), labels of SOs are determined by the Labeling Algorithm (LA), which is minimal search and is separated from Merge.   Chomsky (2013, 2015) indicates how LA applies to (1)[1].

(1)   a. $\{_\alpha \text{ H, XP}\}$

b. $\{_\alpha \text{ XP, YP}\}$

(2)   a. $\{\text{YP, Z } \{_\alpha \text{ XP, t}_{\text{YP}}\}\} \rightarrow \alpha = \text{XP}$

b. $\{_\alpha \text{ XP}_{<\text{F}>}, \text{YP}_{<\text{F}>}\} \rightarrow \alpha = <\text{F, F}>$

In (1a), SO is a set of the head H and the maximal projection XP.   LA selects H as the label. In (1b), SO is a set of two maximal projections XP and YP, which are not a head.   In this case, the label is determined by one of two ways.   One is that one of the SOs YP "moves" and the remaining copy of YP becomes invisible to LA.   As a result, XP is the label as shown in (2a).   The other is that the most prominent feature F, which both XP and YP have, becomes the label of the set as shown in (2b).   This is *feature sharing* (FS).

Labels make SOs interpreted at two interfaces and it is possible that these determine grammatical functions such as subjects, predicates, etc. and theta-roles of argument structures, because Merge just combines two SOs and cannot apply to the determination of these properties.   For example, the labeled structure $<\varphi, \varphi>$ can be treated as a subject-predicate relations at the interfaces as shown in (3).

(3) $[_{\text{CP}} \text{ C } [_{<\varphi, \varphi>} \underbrace{\text{DP}_{<\varphi>}}_{\text{Subject}} \underbrace{\text{T}_{<\varphi>}}_{\text{Predicate}} [_{v\text{P}} \dots]]]$

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[1]   In this paper, I do not deal with the case {H, H}; SO is a set of two heads.

Following this possibility, I explore the LA in topicalization and focalization, which have not been dealt with by Chomsky (2013, 2015).   Cartography assumes that discourse-related features such as topic, focus, etc. are heads of and project each functional projection like TopP or FocP.   These heads trigger a topic element or a focus element into each specifier of these phrases.   As we saw above, however, the cartographic analysis cannot be applied to these constructions in recent studies on minimalism.   In the next section, I present my proposal.

3. Proposal

In this section, I indicate how LA applies to topicalization and focalization.   In these constructions, a topic element and a focus element move to the left periphery of sentences as shown in (4).

(4)   a.   *Your book*, you should give to Paul, (not to Bill). (Topicalization)

b.   **YOUR BOOK** you should give to Paul, (not mine). (Focalization)

Rizzi (2004) divides the features into four types and shows which features belong to the four as shown in (5).

(5)   a.   Argumental: person, number, gender, case

b.   Quantificational: **Wh**, Neg, measure, **focus** ...

c.   Modifier: evaluative, epistemic, Neg, frequentative, celerative, measure,

manner ...

d.   **Topic**   (Rizzi 2004: 243, emphasized by MT)

In (5), focus is the same type of Wh while topic is independent from the other three types. Following this typology, I propose a way of label determinations on focalization and topicalization (6).

(6)   a.   In focalization, the focus element has a Q feature and the feature sharing (FS)

occurs between the focus element and a C head.

b.   Topicalization has the unlabeled structure {XP, YP}.

First, let us consider (6a).   Since focus and Wh are the same type in (5b), I assume that focus can be applied to the same LA on Wh interrogative sentences.   Chomsky (2013, 2015) indicates that an interrogative Wh expression has a Q feature and moves to the left periphery of a sentence.   In Wh interrogatives, the C head has a Q feature.   In this case, therefore, FS occurs between the Wh expression and the C head.   Its label becomes <Q, Q> and is

interpreted as the Wh interrogative sentence at the interfaces as shown in (7a).   In a similar way, the label of focalization is determined.   The focus element has a Q feature and moves to the left periphery of a sentence.   Also, in focalization, the C head has a Q feature and FS occurs between the focus expression and the C head.   The label becomes <Q, Q> and is interpreted as focalization at the interfaces as shown in (7b).   Whether the moved element is a Wh expression or a focus expression reflects the interpretations of the label <Q, Q> as in (7).   However, both of them have an operator-variable relation between the moved element and the in situ position.   I assume that this relation is derived from the label formed by FS. In addition to this, the label formed by FS in focalization is interpreted as a focus-presupposition relation.

(7)   a.   [$_\alpha$ **Wh**$_{<Q>}$ C$_{<Q>}$[$_{TP}$ ... ___]] α = <Q, Q>   →   Wh

b.   [$_\alpha$ **Focus**$_{<Q>}$ C$_{<Q>}$ [$_{TP}$ ... ___]] α = <Q, Q>   →   Focus

Second, let us consider (6b).   As we saw above, Rizzi (2004) separates topic from other types.   He argues that topic has a special property because it is not argumental and quantificational like focus or Wh.   I assume that this property of topic is derived from the LA of topicalization.   Under my proposal, topicalization does not have its label as shown in (8).

(8)   [$_\alpha$ **XP** C [$_{TP}$ ... ___]]   {$_\alpha$ XP, YP}   →   unlabeled = Topic

A topic element moves to the left periphery of a sentence and the construction forms a set {$_\alpha$ XP, YP}.   The set is unlabeled and is interpreted as topicalization at the interfaces.   It is also interpreted as a topic-comment relation.   This unlabeled structure is different from the labeled structures formed by movement or FS in (2) and could have a special property at the interfaces.

Although Chomsky (2013, 2015) argues that labels make SOs interpreted at the interfaces and must be needed, my proposal allows SOs not to have labels.   I assume that SOs can have no labels, if and only if syntactic derivations converge and that the syntactic circumstance where the unlabeled structures occur can be analyzed as root phenomena.

Generally, topicalization can only occur in root sentences as shown in (9).[2]   In a similar way, left dislocation in (10) and finite and infinitival sentential subjects in (11) and (12) can do so.

(9) a. *John*, the article really bothered.

b. ?*I regret that *Mary*, my antics upset as much as they did.

c. ?*Mary wishes that *John*, the article bothered more than it did.

(Alrenga 2005: 179)

(10) a. *This movie*, you wouldn't like it much.

b. * *John's sister*, she won't do anything rash.

c. * I told you that *this movie*, you wouldn't like it much.

d. * Bill hopes that *John's sister*, she won't do anything rash.

(Emonds 2004: 32-33)

(11) a. Although *the house's emptiness* depresses you, it pleases me.

b. ?*Although *that the house is empty* depresses you, it pleases me.

(Alrenga 2005: 178)

(12) a. I regret that our smoking bothers her so much.

b.   Mary wishes that our smoking bothered her more than it did.

c. ?*I regret that *for us to smoke* bothers her so much.

d. ?*Mary wishes that *for us to smoke* bothered her more than it did.

(Alrenga 2005: 178)

These constructions can occur in root sentences, but not in embedded sentences.   Embedded sentences are not at the convergent point of syntactic derivations because the derivations continue to the top of root sentences.   In my proposal, therefore, embedded sentences cannot have   unlabeled structures like (8).   These constructions in embedded sentences cannot be interpreted at the interfaces because Chomsky (2013: 45) argues that an intermediate position has no label as shown in (13).

(13) they thought [$_\alpha$ in which Texas city [$_\beta$ C [JFK was assassinated]]]

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[2] Hooper and Thompson (1973), Bianchi and Frascarelli (2010), and Miyagawa (2017) argue whether topicalization can occur in embedded sentences.   They discuss the semantic property of this issue and if it is important whether embedded sentences have "root like" circumstances or not.   Following my proposal, the "root-like" property may be derived from LA.   I leave this issue for future research.

In (13), the C head in the embedded sentence does not have a Q feature because it has a declarative property, not an interrogative one.   Therefore, FS between the C head and the Wh expression does not occur in the sentence, α has no label and the sentence (13) cannot be interpreted at the interfaces.

4. Asymmetries between Topicalization and Focalization

In this section, I show how my proposal explains the three asymmetries between topicalization and focalization from the view of LA: the formation of phonological boundaries, word order constraints, and island effects.

4.1. *Intonational Phrase*

There is a phonological difference between topicalization and focalization as shown in (14).

(14) a.   (*Your book*)$_{IntP}$, (you should give to Paul.)$_{IntP}$ (Topicalization)
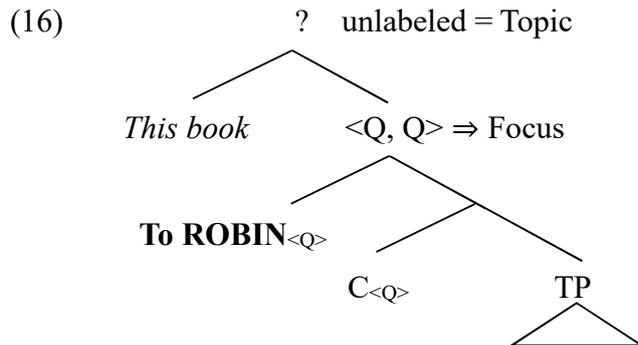   b.   (**YOUR BOOK** you should give to Paul.)$_{IntP}$ (Focalization)

Topicalization in (14a) must show a comma pause while focalization in (14b) must not.   In addition to this, in the former, the topic element and the rest of sentence form each Intonational Phrase (IntP), whereas, in the latter, the whole sentence forms an IntP.   Based on my proposal, let us consider the asymmetry.   In (14a), topicalization has the unlabeled structure {XP, YP}, and the topic element XP and the rest of sentence YP are interpreted as separate units at the SM interface, not the whole unit.   As a result, each unit forms their own IntPs.   On the other hand, in (14b), focalization has the labeled structure formed by FS <Q, Q>.   The focus element and the following sentence are interpreted as one unit at the SM interfaces, and form the whole one IntP.
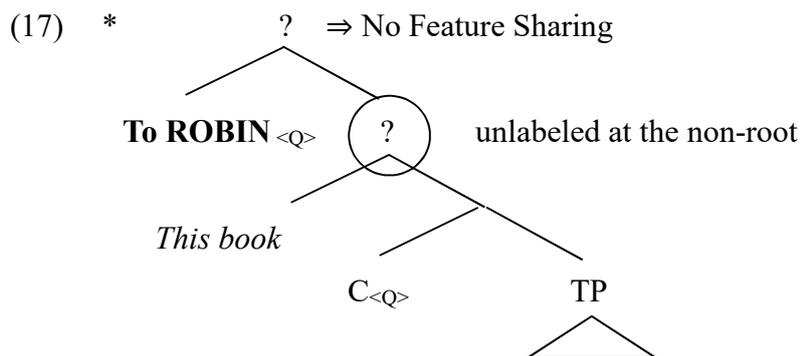
4.2. *Word Order*

When topicalization and focalization cooccur in the same sentence, a topic element must precede a focus element as shown in (15a).   When a focus element precedes a topic element, the sentence becomes ungrammatical as shown in (15b).   Based on my proposal, let us consider the second asymmetry.

(15) a.   *This book*$_i$ **to ROBIN**$_j$ I gave t_i t_j.
      b. * **To ROBIN**$_j$ *this book*$_i$ I gave t_i t_j.   (Culicover (1991: 33))

In (15a), first, the focus element **to ROBIN** moves to the left periphery of the sentence and FS between the element and the C head occurs.   The label becomes <Q, Q>.   Second, the topic element *this book* moves to the higher left periphery of the sentence and the unlabeled structure {XP, YP} is formed.   Finally, the whole sentence can be interpreted at the interfaces because the derivation converges at this point.   In this case, the label <Q, Q> is interpreted as focalization and the unlabeled structure as topicalization, as shown in (16).

(16)   ?   unlabeled = Topic

              This book   <Q, Q> ⇒ Focus

                  To ROBIN_{<Q>}

                                $C_{<Q>}$ TP

On the other hand, in (15b), first, the topic element *this book* moves to the left periphery of the sentence and the unlabeled structure {XP, YP} is formed.   Second, the focus element **to ROBIN** moves to the higher left periphery of the sentence.   In contrast with (15a), FS between the focus element and the rest of sentence cannot occur at this point because both of them are not involved in "spec-head configuration" and minimal search of FS does not work.   Also, the unlabeled structure formed in the first step is not at the convergent point and cannot be interpreted at the interfaces.   Finally, in either case, the sentence becomes ungrammatical.

(17)   *   ?   ⇒ No Feature Sharing

            To ROBIN _{<Q>} (?)   unlabeled at the non-root

                  This book

                                $C_{<Q>}$ TP

4.3. *Topic Island*

Topicalization induces a syntactic island from which extraction of elements is banned, while focalization does not.   This is illustrated by the following examples.

(18) a.   *These prices*$_i$, **to whom**$_j$ should we give t$_i$ t$_j$?   (Watanabe (1988: 129))

     b. * **To whom**$_j$ *these prices*$_i$, should we give t$_i$ t$_j$?   (Pesetsky (1989: 13))

(19) a. *Suzanne*$_j$, **what else**$_i$, does she$_j$ do t$_i$ to relax?

     b. * **What else**$_i$, *Suzanne*$_j$, does she$_j$ do t$_i$ to relax?   (Emonds (2012:38))

In Rizzi (2004), this island effect is analyzed by *Relativized Minimality* (RM), but he wrongly predicts that all of them are grammatical because topic and focus are not the same type as shown in (5) and this island effect is not induced.   Therefore, his approach cannot account for the problem where topicalization induces an island and focalization does not.

     This problem is solved by my proposal.   As we saw in section 4.2., when the Wh element precedes the topic element, FS between the focus element and the rest of sentence cannot occur at this point because both of them are not involved in "spec-head configuration" and minimal search of FS does not work.   Also, the unlabeled structure formed in the first step is not at the convergent point and cannot be interpreted at the interfaces.   Finally, in either case, the sentence becomes ungrammatical.

5. Concluding Remarks

     In this paper, following Chomsky (2013, 2015), I indicated how LA applies to topicalization and focalization, which are phenomena of the left periphery in sentences.   In particular, following Rizzi's (2004) typology of features, I proposed a way of label determination in focalization and topicalization; in focalization, the focus element has a Q feature and the feature sharing (FS) occurs between the focus element and a C head while topicalization has the unlabeled structure {XP, YP}.   I showed the possibility that the structure of hierarchical functional projections assumed by Cartography is derived from LA.

     Although Chomsky (2013, 2015) does not allow a structure that has no label, I assume that topicalization can have an unlabeled structure.   It is important to explore whether other phenomena can have unlabeled structures like topicalization.   Hornstein and Nunes (2008) and Hornstein (2009) argue that adjunct structures have no label.   They propose that Merge is decomposed into concatenation and labeling and argument structures are built by these two operations whereas adjunct structures are built by one concatenation operation.   Therefore, adjuncts only concatenate building structures and have no label.   Though their theory of labeling is different with Chomsky's LA (2013, 2015), their theory is very intriguing in that it has many similarities and differences with mine.   I leave this issue for future research.

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