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A study on the Numeration
- A focus on functional categories -

Kim, Myoung-kwang*

Abstract

This paper clarifies the functions and roles of the Numeration assumed in Minimalism and what categories are included in the elements of the Numeration. A numeration is a set of LIs' as an array at worktable for C_{HL} in which only those necessary for the operation of syntax to derive a correct structure are selected. It participates in C_{HL} sometimes with an integration of features, sometimes with separated features. This operation is ultimately intended to act as a suitable interpretation that converges in the PF and LF. An element of (N) consists of a pair of (LI, *i*) in which LI refers to a lexeme and *i* refers to the index of how many times the LI is used to participate in C_{HL}. The process of operation generating a syntactic object at each level of C_{HL} will not stop until the index becomes zero. The (N) provides the LIs' for a deriving structure determining the reference set, and the cause of the features' check. This paper explained it with some examples of Korean that the (N) also worked as a criterion for determining which was the correct or not among competitive derivations. This set of (N) is used as materials for the minimal computation of derivation and prepares the basis for a very limited basic operation in the external and internal movements of the syntax. Examples The operation of the (N) include Select, Merge, Move, and Agree. Next, it was argued that the functional category should be arrayed in a separate space called discourse numeration((DN)) because it serves as a discourse-level information structure rather than as the (N) for syntactic C_{HL}. For example, in Korean, the functional categories 'Top, Foc' in the information structure level such as 'topic' and 'focus' should be checked at the information structure level. These categories correspond to the phases of "discourse model, situational knowledge, encyclopedia knowledge, etc." This can be seen as similar to the (N), which is the space of an operating system for the working LIs' selected from the lexicon before a syntactic object enters the computational process.

Since functional categories, such as C, T, and I, have a check relationship in a phase beyond the sentence dimension, the possibility of expanding these functional categories to elements of the discourse selection set was also carefully presented. With this assumption, the discourse selection set should be constructed before (N) is constructed. Functional categories such as C, T, and I have a checking chain in the phase beyond the syntactic level. Therefore, it was suggested that these functional categories should also be incorporated as elements of the (DN). With this assumption, the (DN) must exist independently before the (N) is constructed.

Keywords: *Numeration, Functional categories, Select, Merge, Discourse Numeration*

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* E-mail: kimmk0857@daegu.ac.kr

* Ph.D. earned at: Sogang University

* Current position: Professor of Korean Literature Department at Daegu University (The Head of Multicultural Society Policy Research Institute of Daegu University)

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배번 집합에 대한 연구
- 기능 범주를 중심으로 -

김명광

국문요약

이 글은 최소주의 이론에서 가정하는 배번 집합의 기능과 역할과 그리고 이 집합의 원소에는 어떤 범주가 들어가는지를 살펴본다. 특히 기능 범주의 경우 무형의 형태를 띠기 때문에 가시적인 형태만을 다루는 최소주의에서 어떻게 처리되는 것이 합리적인가를 밝히고자 하였다. 우선 배번집합은 통사부 운용에 필요한 것들만 선택되는 작업용 어휘소 집합으로, 때로는 어휘적 형태로 때로는 자질로서 통사 운용에 참여함을 말하였다. 배번 집합의 어휘소들은 때로는 어휘 항목으로 때로는 어휘 항목이 가지고 있는 자질들의 점검 관계를 통해 통사부에서 운용된다. 통사부 운용의 예에는 선택(Select), 병합(Merge), 이동(Move), 일치(Agree) 등이 있다. 다음에 기능 범주의 경우 배번 집합의 어휘소보다는 담화 차원의 정보 구조로서의 역할을 하기 때문에 담화 선택 집합(Discourse Numeration)이라는 별도의 공간 속의 원소로 두어야 함을 논증하였다. 예컨대, 한국어의 경우 '화제(topic)'와 '초점(focus)'과 같은 정보 구조 차원의 기능 범주 'Top, Foc'는 정보 구조 차원에서 점검되어야 한다. 더 나아가 C, T, I와 같은 기능 범주들도 문장 차원을 넘어선 국면에서 점검 관계를 갖기 때문에 이러한 기능 범주들도 정보 구조 차원에서 점검되어야 함을 논증하였다. 따라서 이러한 기능 범주를 위한 작업용 공간인 담화 선택 집합(Discourse Numeration)의 설정이 필요함을 밝혔다. 이러한 가정을 하면 담화 선택 집합은 배번 집합이 구성되기 이전에 구성되어야 한다의 맥을 같이 한다.

주제어: 배번 집합, 기능 범주, 선택, 병합, 담화 선택 집합

I. Introduction

The purpose of this paper is to examine the function and role of the 'Numeration (hereafter referred to as (N))' assumed in the theory of minimalism. It also identifies which items are included in the (N). In particular, it discusses whether functional categories other than lexical categories can be set in the (N) or should be set in a separate space similar to (N). The departments assumed in the minimalism model are 'Lexicon, Numeration, Phonetic Form (PF), and Logical Form (LF)'. Each of these departments is computed organically to derive a suitable sentence. The computational process of deriving it consists of two operations. One of the two operations is Overt Syntax (OS) before Spell-Out and the other Covert Syntax (CS) after Spell-Out (refer to 'section 2: Minimalism Model' in detail). Minimalism in Chomsky (2013:38) is a philosophical attempt to generate various surface forms generated by universal grammar with a few linguistic principles of concise and economic efficiency. Minimalism serves as a criterion for judging the validity of the existence of many sub-modules proposed in the existing GB theory, such as 'Case theory, Binding theory, Control theory, Governing theory, Movement theory, Semantic theory, and X-bar theory, etc.'. It, therefore, has a high meta-property (Hornstein et al., 2005, Kim, S.W., 2010).

Minimalism bases on the simplest assumption that the essence of language is the combination of sound and meaning. Therefore, theoretical by-products, such as arbitrary rules as bar-level or trace, Empty Category Principle(ECM), and governance to explain syntactic phenomena, etc., are to be excluded as much as possible. Furthermore, from the viewpoint of minimalism, no syntactic layers-Deep Structure (DS) and Surface Structure (SS) except for the Phonetic Form (PF) and Logical Form (LF)- are allowed. These assumptions were inevitably declarative in the early days but have been gradually theorized as Minimalism established its own order and system.

On the other hand, GB theory has the view of the so-called 'Post-lexical rules' that select lexical items from the lexicon after projection, but minimalism changed it to the view of 'Pre-lexical rules' in which a set of lexical items (hereafter referred to as LIs') should be arrayed before the syntactic operation. It has newly illuminated the lexical department as a reference for selecting the LIs' to be included in the (N). In this paper, I will examine the location and role of the (N) for syntactic derivation, which is a source of supply in the process of syntactic operation. Particularly, I will discuss whether it is possible to set functional categories in an independent space other than (N).

II. The location of the 'Numeration' in a syntax operation module of Minimalism

Minimalism was proposed in the mid-1990s. This theory was formed from critical reflection on the previous GB theory (Government-Binding Theory). In the GB theory, there were both deep and surface structures to which the syntactic principle as well as the phonetic form (PF) and logical form (LF) was applied. Syntax principles, which deals with Semantic role, Phrase structure, and Binding algorism, were applied in the deep structure, and syntactic modules, such as Case, Binding condition, Extended Projection Principle (EPP), Subjacency, and Move, were applied in the surface structure. However, in the theory of minimalism, as briefly

mentioned in the introduction, It does not set any layers other than PF and LF that deal with sound and meaning, which is the essential characteristic of language. Figure 1 as below is the one of 'syntax operation module (SOM)' assumed by Minimalism.

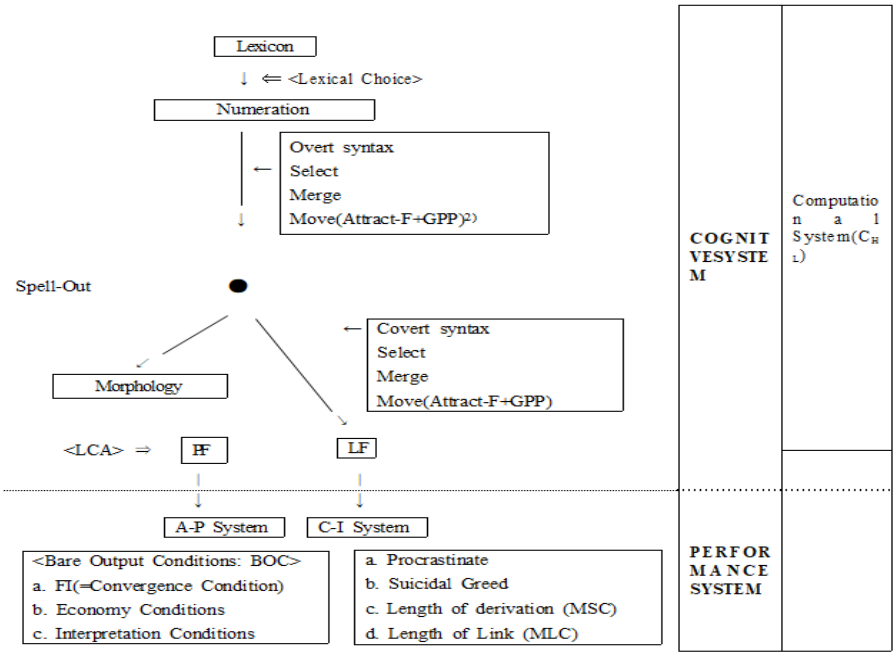


Figure 1. The Syntactic Operations Modules in view of Minimalism

This module is called 'Attract–F System' because the operation of 'selection, movement, matching, and merge' is implemented in a way that a feature attracts others for being checked off to eliminate the uninterpretable feature to construct a legal structure after a lexeme is disintegrated to features on the stage of 'Spell-Out'. The SOM is largely composed of lexicon(L), Numeration ((N)), a Phonetic form (PF), and a Logic form part (LF). The process from deriving structure to 'Spell-Out' is called overt syntax (OS). The process of deriving LF after segregation of features is called covert syntax (CS).

Each LIs' of Lexicon is a chunk of features that consists of phonological, semantic, and formal features. The necessary LIs' for derivation are selected as a lump in the lexicon, to be arrayed in (N). Each LIs' of (N), also, is selected for deriving a structure by a process of merge and move, etc.

- This paper emphasizes that the start of this module is not from syntactic operation, but from (N), and again, the lexemes of (N) selected from lexicon serve as a reference that can participate in the ensuing syntactic module. In addition, the lexemes of (N) participate in the syntactic operation as disintegrated features (Post Spell-Out). As a result, (N) ultimately serves as a suitable material–for legal interpretation that matches in the PF and LF.

The operation that occurs before the features' separation (the operation of the OS) is one for Lexemes themselves (OS units), which is an integration of features. And its operation affects both sound and meaning. On the other hand, the OS units are a kind of phonetic forms where

sound, meaning, and formal features are not yet split. They separate into the features after 'Spell-Out'; the features governing AP (the Articulatory-Perceptual interface system) enter into PF and the CI (Conceptual-Intentional interface system) into LF. More accurately, the phonetic features participate in the process of the PF and the others (semantic features and formal ones) in that of LF, which waits for being checked in order to derive a legal structure. At LF track, the formal features are subject to a Probe-Goal. The formal features that are not necessary for the LF disappear during the operation process. In the end, only pure semantic features remain in the LF, and these are interpreted properly in semantics.

Syntactic operation (a checking process of features) that occurs after feature separation, affects only meaning. It can be called a covert syntax because it is an operation that affects the meaning and does not realize the phoneme (that is sound). However, these computations must be processed before entering the PF and LF stages, and the principle of CS is a kind of UG constraint (one of the constraints within the universal grammar) known as the principle of full interpretation (PFI). In other words, the PFI plays a role of 'filter' so that there would remain only the features that are 'directly necessary' to help legal interpretations at each level (whether PF or LF). By this principle, only the features required at the PF layer and the LF layer should exist in the grammar module (that is a separated feature stage). Furthermore, if syntactic objects manifest only the features that can be interpreted, we can call them the 'PFI Converge'.

III. The role of Numeration

As previously mentioned in Section 2, the (N) operates first in the process of forming a structure in the syntax operation module matching it into the LF. That is, the first operation is to choose lexical items (i.e., lexemes) of the lexicon for generating a structure in the computational system C_{HL}. Therefore, the array of lexical choices is referred to as a numeration (N), which Chomsky (1995: 225) defines as:

> (1) A numeration is a set of pairs (LI, *i*), where LI is an item of the lexicon and *i* is its index, understood to be the number of times that LI is selected to be included in a given derivation (Chomsky, 1995:225-226).

(N) does not array all LIs' of lexicon by introducing all into the syntactic C_{HL}. But it is just arranged by selecting only the LIs' which are directly involved in the language operation system in order to express a specific thought as a language. As a metaphor, it is a kind of worktable on which LIs are arrayed for entering the next procedure of C_{HL}. But, why does Minimalist theory need such a worktable (i.e., Numeration)? In this regard, Jang, Y. J. (1999:121-122) referred to the necessities as follows.

(2) (N) can be understood as acting as a kind of intermediate station. In other words, the lexical items of lexicon (including the lexical categories and the functional categories) to be used for syntactic derivation are arrayed in the (N), and a structure extends to form by merge and movement out of the LIs of (N). What the (N) does is: First of all, to supply LIs of (N) to C_{HL}. Secondly, to determine the reference set. Thirdly, provide a cause to check the features……. The (N) selects only the most optimal derivation among various ones (Young Jun Jang, 1999:121-122).

It is very inefficient that one should access the lexicon at every stage of the C_{HL} for completing a structure. Chomsky (1999) further reduces the complexity involved in these operations. The main points are the following:

(3) a. Reduced access to the lexicon: derivations make a one-time selection of a lexical array (LA) from the lexicon. In this way, the derivation does not access the lexicon at every point. This implies that the information contained in lexicon, once it is selected, will no longer be needed. Thus, the derivation will not have to carry the lexicon along and therefore burden complexity is reduced.

b. Reduced operative complexity: a language makes a one-time selection of a subset of features (F) dispensing with further access to it. At the same time, there applies a one-time operation that assembles elements of the subset of features into elements of the lexicon to build an expression. Therefore, both feature selection and feature-element assembling are operations that apply once and only once; when the corresponding features are selected and assembled to an element, no further select/merge operations will take place.

Chomsky(1998:13) also addresses the inefficiency in direct selection from lexicon.

(4) If the derivation accesses the lexicon at every point, it must carry along this huge beast, rather like cars that constantly have to replenish their fuel supply (Chomsky, 1998:13).

Otherwise, the setup of (N) will have an efficiency as below.

(5) In economic aspect, all of derivations which are in competition must be generated from the same set of elements in (N). …… In other words, the same elements in (N) set to go through different computational operations. As a result, different derivations are generated. Among them, the ones that are converged legally in FI principle are in competition. In the last phase, the only one among them can be "LF representation λ", but the another eliminated by economic condition at the logical form layer(LF). Therefore, the last λ are optimal derivation(Kim, Y.S., 2005:32-33)

The candidates for the optimal derivation to LF in competition must use the same elements to generate a sentence. I explain this with a Korean sentence as below.

(6) a. 중대본은 수도권 주민들이 방역을 잘 준수하기를 요청하였다.

중대본은 [수도권 주민들이 방역을 잘 준수하기]를 요청하였다.

※ 중대본-은 수도권 주민들-이

Jungdaebon-un sudokwon jumindeul-i

Central Disaster and Safety Metropolitan area inhabitants

방역-을 잘 준수하기를 요청하였다.

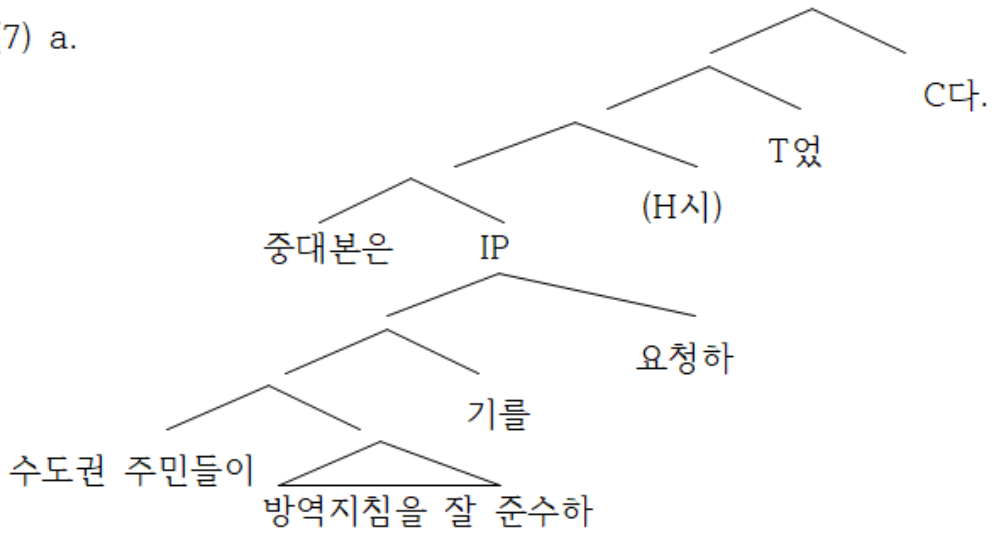
bangyeog-eul jal junsuhagi-leul yocheonghayeotta.

Prevention rules well to comply requested

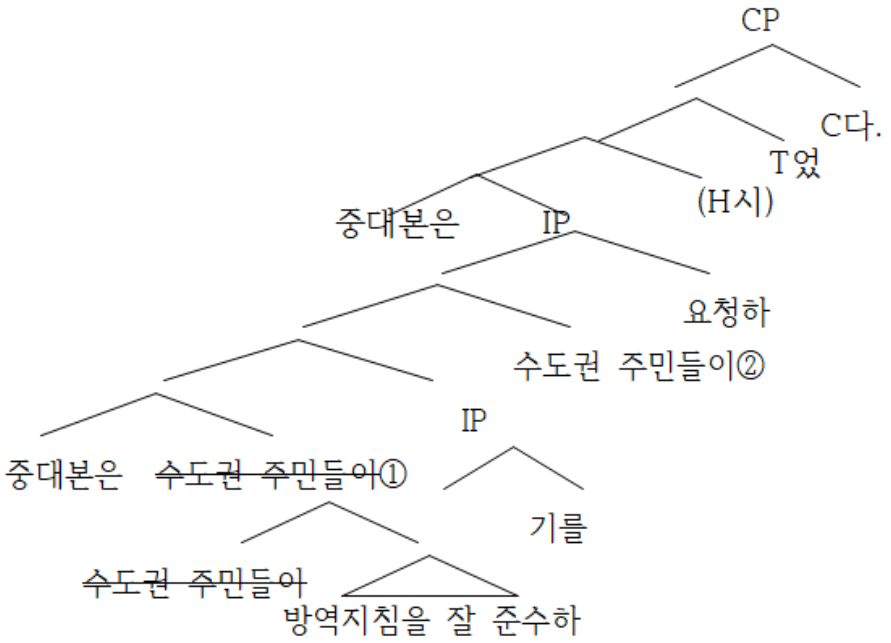
b. 중대본은 [방역지침을 잘 준수하기]를 수도권 주민들이 요청하였다.

*중대본은 수도권 주민들이 [수도권 주민들이 방역지침을 잘 준수하기를] 수도권 주민들이 요청하였다.

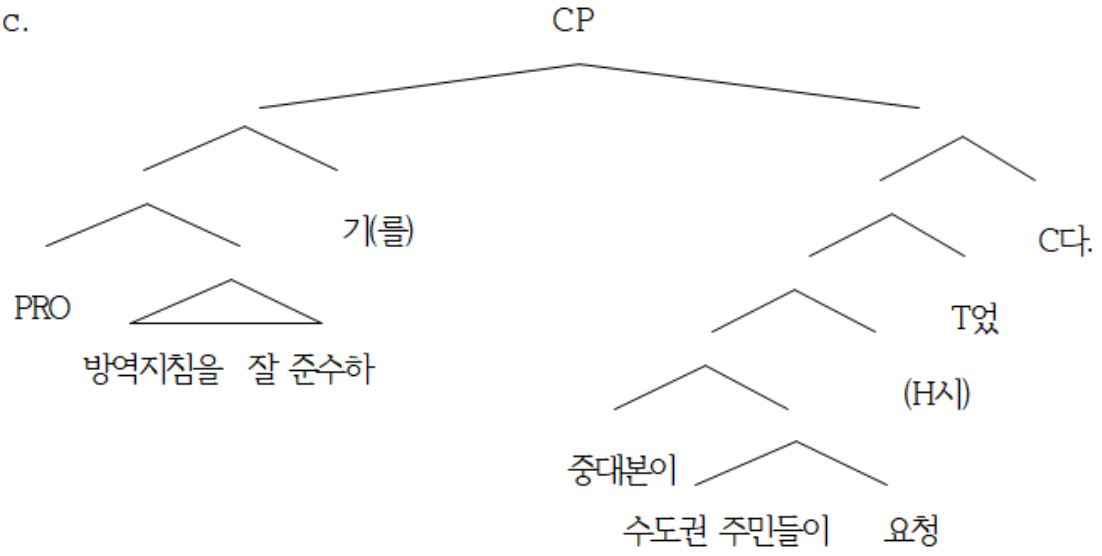
(7) a.



b.



c.



In (6a) and (6b) above, the same LIs are used, but different structures of derivations are generated. In (7a), both the θ-role and case of 'sudokwon jumindeul(inhabitants of the metropolitan area)' are checked legally in the IP phase '-gi'. On the other hand, in (7b), despite of the fact that both the θ-role and the case are checked in the IP phase, the EPP features are unnecessarily checked again in the CP phase over IP (①). Therefore, the subjects collide with

each other. It is very inefficient in economic condition as it projects to the complement slot of the main clause (②) and further, it goes through an unnecessary step of moving against the barrier '-gi (I)'. Of course, it is possible to assume PRO as in (7c), in order to avoid such a complicated step, but it violates the inclusiveness condition (see the next section), which does not assume unnecessary elements in the operation of C_{HL}. Therefore, the (N) plays an important role in verifying the effectiveness aspect of the economic feasibility that minimalism sets on.

The set of (N) is used as materials for the minimalist derivation in very limited C_{HL} operation such as external and internal movements of the syntactic objects. And 'Select, Merge, Move, and Agree' show typical examples of syntactic operations as below.

(8) a. Select

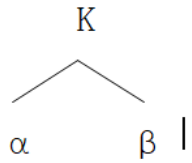
The selection is one among operations in Computational System(C_{HL}). Select is an operation of C_{HL} that selects a lexical item LI, and introduces it into the derivation as SOn+l.

b. Merge

① Merge is an operation of C_{HL} that takes a pair of syntactic objects (SOi, SOj) and replaces them by a new combined syntactic object SO_{i+j}(Zeijlstra, 2004:15).

② K = {α/β, {α, β}}

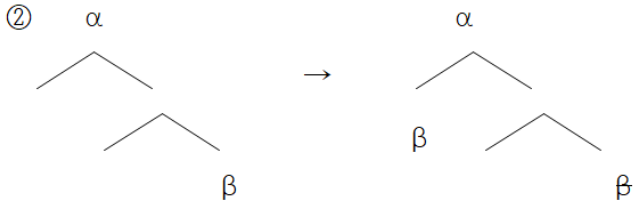
③



c. Move=Internal merge

① Internal Merge yields the effects of syntactic movement. The displaced element such as β ..... instead of being copied and merged into a new position, is simply remerged/internally merged into its new position (Barbara, 2005:475-496).

②



d. Agreement

① By Full interpretation principle, uninterpretable features(uFs) among that lexeme have,

are checked and deleted in order that uFs match iFs to agree with. The process of the operation keeps only interpretable features, and, further, can make morphological change.

② Minimal search : Probe P agrees with Goal K in C-command domain. If necessary, K can move the place of the specifier of P.

③ Activity condition : Goal as well as Probe must be active, by virtue of having uninterpretable features, for Agree to apply(Chomsky, 2000:123, 2001:6).

④ Locality condition: If K has also the feature with which make an agreement to Probe and Goal, K causes an interferential effect that blocks the agreement relation to P and M.

The selection as above(8a) is an operation of C_{HL} that selects a lexical item LI, and introduces it into derivation. The basic element of (N) is composed of an LI and an index indicating how many the LI is selected in the operation of C_{HL}, that is a pair of (LI, i).

The operation of selection has some characteristics. First, the LI only used in overt or covert syntax is eligible for the elements in (N). Secondly, the elements of the (N) are operated by the LI as a whole in the overt syntax. Each LI dis-assemble with features in the covert syntax (post 'Spell-Out'), being mutually checked by FI(Full interpretation). Thirdly, each time a lexical item is selected from the (N), its index is reduced by one so that the converging derivation (i.e., the one that forms a linguistic expression) is the one for which *i* is reduced to zero.

For example,

(9) '그 차가 너가 말한 그 차냐?'

※ 그 차 -가 너 –가 말한 그 차냐?

keu cha-ga neo-ga malhan keu chanya?

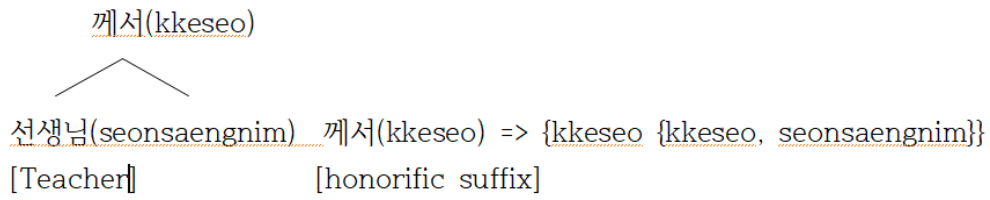
that car you tell that car is?

Cha[car] appears two times in the sentence above, so the (N) of Cha can be represented by (cha, 2). Whenever cha is in use for a converging derivation, the index will be reduced by one till to zero. This means the C_{HL} configuration of derivation is not completed unless it runs out of LIs.

The merge is the process of combining one LI with another LI, which is the most essential and basic operation of the syntax. The syntactic structure is formed through the configuration of merging. Chomsky (1995:296) proposed the operation Merge: "One such operation is necessary on conceptual grounds alone: an operation that forms larger units out of those already constructed, call it Merge.". The result of merging is composed of the two merged

elements and a projected label (Hornstein & Nunes, 2008:57-86). In this case, the labeling of the category is one of the two elements merged. The salient property of the two elements merged is expressed as a representative category label.

(10) The labeling of merge in Bare Phrase Structure



In the minimalist theory, the concept of merge is necessary to project the concept of reality by allowing infinite combination of language symbols through external merge including set merge and pair merge. It also plays a role as the basic function of the conceptual-intentional interface system that produces the ability of language planning and thinking, and generates the mental creation of the possible world. Therefore, Chomsky (1995) considers that combining LI and LI is the most essential and basic operation of the syntactic department, and explains the principle of forming the phrase structure through the operation of merge.

However, the category label for these nodes consists only of lexical features and elements projected from them, unlike what minimalist theory was in the past. The reason is that the principle of minimalism is applied to explain configuration of syntactic structures, which means that no features other than lexical ones are newly introduced.

Chomsky (2004:110) and Epstein (1999:320) also made the crucial observation that there is just one operation, Merge, with two subcases: internal and external Merge. Merge(X, Y) is external Merge(EM) if X and Y are separate objects. Merge(X, Y) is internal Merge(IM) if either X contains Y or Y contains X. In effect, phrase structure rules and transformations collapse into a single operation. External merge is a basic operation that generates a new phrase structure, and internal merge is more or less a complicated operation in which one LI appears twice in the syntactic structure and give rise to a movement.

(11) a. External Merge

b. Internal Merge=MOVE(=9c)

External merge is canonically called merging operation in that it takes a subpart of an existing structure as one of the two objects. But internal merge (9c, 11b) was previously referred to as Move (before Minimalism), in that either of them is part of the other. The reason for Internal Merge instead of Move is to clearly the complex process of operations such as Copy, Delete, and Merge rather than displacement as the result of operations(See 8c②).

Agreement in (9d) is one of the syntactic operation procedures that checks uninterpretable features (uF) and deletes them among the LF's features of the (N). Agreement syntactically removes the uninterpretable features by matching the uF with the corresponding interpretable features (iF). It morphologically gives the value of a lexical feature. It is necessary to understand representative syntactic features for understanding operation procedure. (Chomsky, 1995:277).

(12) a. Categorical features: N, V, n, v, T, D, C .....

b. φ-features: Gender, Number, Person .....

c. Case features: Structural case, Non-structural case .....

d. Strength feature: Strong F, Weak F

The categorical features in (12a) are those that are responsible for merge and distribution of the LIs. φ-features are ones that trigger morphological agreement such as gender, number, and person, and the specific LIs also can be displaced in the process of agreement.

Case features are morphological ones that are assigned to noun phrases by syntactic distribution, and are largely divided into structural and non-structural type(lexical case and inherent case). The strength feature is one that indicates whether the feature must be checked through in situ movement(overt movement) or in situ(covert movement) in the logical form (LF). Strong features trigger visible movement, while weak ones invisible movement.

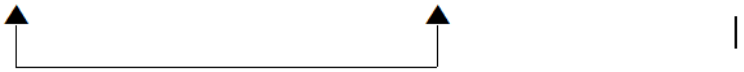
In the minimalism model proposed by Chomsky (2000, 2001), the uF's of both sides-a probe(a functional head with uF's/iF's), and a goal(a constituent with uF's/iF's) corresponding to them, are removed by iF's in the mutual party with long-distance agreement between them. It is necessary to have a syntactic positional relationship in which the probe c-commands the goal in order to get an agreement between them. All uF's in the syntactic derivation stage ~~is~~ are required to be checked and removed in order for the structure to successfully reach PF stage.

In this model, 'Nominative assignment and Predicate's Agreement' as below (13) is that the Infl (with nominative features and uninterpretable φ-features) 'AGREEs' with case feature(yet to be undetermined) and φ-features of NP(already to be determined). As the result, the uninterpretable feature of noun is assigned as the nominative, and the uninterpretable φ -feature of Infl is assigned equal to the φ-features of the noun(Jung, H.K., 2013:156-157).

(13) Probe Goal

α β

Infl [uϕ, NOM] NP [Gender/Pl, uCase]



The operation procedure between probe and goal is under the control of the condition such as Full Interpretation, Minimal search, Activity, Locality.

IV. Functional categories

I shall discuss whether or not functional categories can set the elements of the (N) in the assumption of minimalist theory, with an example as follows:

(14) a. 내 친구-가 네 친구를 만났다.

Nae chingu-ga ne chingu-leul mannatta.

My friend-with your friend meet+PL.

b. {(nae, 1), (chingu, 2), (ga, 1), (ne, 1), (wa, 1), (manna, 1), (at, 1), (ta, 1)}

The sentence (14a) above is derivated from (N) as (14b). As I briefly looked at in the previous section, an element of (N) consist of an LI and an index(the account number of LI). For example, in the sentence (14a), 'friend' appears twice, so it is expressed as (friend, 2). On the other hand, there exists a set of syntactic objects {SO1, …, SOn} assuming that, at some stage S in a derivation D, syntactic objects are extended the SOn to SOn+1 by entering the next stage of syntactic C_{HL} providing LIs' LI selected from the (N) as reducing the LIs index by 1. In other words, it is introduced as an indexed syntactic object SO_{n+1} (Chomsky, 1995:226). If it is assumed that the sentence above has derivation process twice in C_{HL}, the first syntactic object(SO1) is VP '네 친구를 만나', and, therefore, index 2 of friend will be reduced to 1 like(friend, 1) in (N). And then, if the derivation operates further, the second syntactic object(SO2) is IP '내 친구가 네 친구를 만나', and thus index 1 of friend will be reduced to 0 like(friend, 0) in (N) to complete a sentence

However, the elements of the (N) can be modified as shown (15) if there are other categories, that is, functional categories, in addition to the lexical ones in the elements of the (N).

(15) a. 내 친구가 네 친구를 만났다.

b. {(T, 1), (C, 1), (D, 2), (내, 1), (친구, 2), (네, 1), (를 1), (만나, 1), (았, 1), (다, 1)}

Adding these features, as the derivation proceeds in (N), seems to violate the inclusiveness condition in the following sense:

(16) Inclusiveness

a. The inclusiveness condition: The machinery of syntax (C_{HL}) does not introduce any new features not already contained in the lexical items (Chomsky, 1998:225).

b. Given the numeration N, C_{HL} computes until it forms a derivation that converges at PF and LF [...] A "perfect language" should meet the condition of inclusiveness: any structure formed by the computation [...] is constituted of elements already present in the lexical items selected for N; no new objects are added in the course of computation apart from rearrangements of lexical properties (Chomsky, 1995:228)

(17) α enters the numeration only if it has an effect on output(Chomsky, 1995:294).

In other words, if the inclusiveness condition above (15) is accepted, in a literal sense, it raises the question of whether the functional categories can exist in the (N). This is because functional categories such as C, T, and I are intangible (or invisible). In other words, they have no lexical sense. In the case of English, those may be checked by the operation of the syntactic C_{HL}: or at least acceptable in theory, in that C can be visible by 'that'(or displacement of 'Wh-'), T to 'ed', and I to 'to'. However, it is the result of an abstract argumentation in that the functional categories are just guaranteed with support of practical lexical categories. In English, the usefulness of functional categories may be proven without violating the conditions of (16) if it is necessary to check the feature of LI in the phases such as V to v, I to T, T to C, etc., in which the phase chain between syntactic objects forms for agreement. However, as mentioned in Chomsky (1995), if the head and either adjunct or head is only projected(percolated) to form a node, it still remains the question of whether the functional categories must be included in the (N). In other words, the hassle assumption that (N) included in the elements of functional categories can be avoided, assuming that the visible LI itself has inherent categorical features such as C, T, I in a type of agreement features that require to agree an L1 to another LI.

So what about the Korean language? In the case of Korean, the functional category of C can be guaranteed by a final ending suffix, such as'-da, -ni', T by a non-final ending suffix such as'-yeot/get/neun-', and I by a gerundive ending suffix such as'-ki'(whether ki- is I or not is in controversy) parallel to the same logic formulation of English.

In English, the rationale for these functional categories can be additionally verified to get in various ways, such as phonological contraction in English or displacement in syntactic

operations. However, there is no phonological change in Korean. Even worse, there is no movement on the surface structure (or the movement in situ in implicit syntax). Therefore, the rationale of assigning a functional category to the (N) is less persuasive than English'. Above all, it is led to violate (17) above if the functional categories are included in the (N) on the basis of any theoretical necessity. It has inherently a cyclical contradiction that refers to the computational operations that will take place in the future and assigns the functional category to LI itself, in that the inclusiveness condition must be generated only from the features that the LI in the (N) may have. Thus, (17) seems to be a condition to supplement (16) at first glance, but this is only a declarative statement that says, "Only the functional category helps the output enter the (N)."

Furthermore, in the case of Korean, the information structures at discourse-level beyond sentence level are sometimes explicitly marked morphologically (in other words visibly) as grammatical categories in sentences, which raise the question of how to deal with them.

For example, in the case of Korean, the functional categories of 'Top, Focus' such as topic and focus must be checked at the level of discourse because the information structure reflects the so-called recognition strategy in the grammar form in a sentence to effectively convey the proposition to the listener while considering the discourse environment. because the information structure is that it reflects perception at discourse-level with grammar forms in sentence in order to effectively convey the propositions what you want to express with in mind. This is a reflection of the speaker's attitude toward a proposition (or event). In simple terms, it is projected into the grammar categories that the speaker's 'perception or attitude' toward the discourse' phases. Information structures outside the language must map on to syntactic elements (visible grammatical forms) within the language. Functional categories such as Top and Foc, therefore, play a mediating role in this connection. In other words, Agreement checks such as topics and propositions are necessary functional categories in the dimension of creating a discourse context. In other words, the Feature checking operation such as topic and focus requires an extended chain in discourse phase.

(18) Analysis of information units in the context of the discourse

a. Pair set of 'Question-Answer' → Focus' preferred analysis

b. First mentioned utterance → Topic's Preferred analysis

The sentence above is mentioned in Byung-Ho, Ham(2018:330), suggesting that it should be looked at in the context of the discourse in order for the functional category of 'Foc(Focus)' to be established. The functional category of the Top(Topic) also can be established similar to it, in that the information structure of Topic is also considered in the context of the discourse because the structure changes depending on whether the content is first or not for the listener (A constituent in a structure moves to the front than the others' if it gets a focus).

The auxiliary postpositional particles (19a) such as ‘eun/neun(-은/는), i/ga(이/가)’ or external movement phenomenon of (19b) supports the validity of the functional categories such as focus and topic even if there are exceptions.

(19) a. Topic : (철수가 도둑을 뒤쫓아 갔다.) 도둑은 철수가 팔을 잡으려 했지만 잡히지 않았다.

※ 철수 -가 도둑 -을 뒤쫓아 갔다.

Cheulsu-ga doduk-eul duijjocha gaktta.

Cheulsu thief chased (Cheulsu chased the thief).

도둑 -은 철수 -가 팔 -을 잡으려 했지만 잡히지 않았다

Doduk-eun, Cheulsu-ga pal-eul jabryeu haetjjiman, japiji anat.ta.

Thief CHeulsu arm grab try to but grab not

(The Cheulsu tried to grab the arm of the thief, but he couldn't.)

b. Focus : 순희가 누구에게 책 한권을 선물했어?

유리에게 순희가 책 한권을 선물했지.

※ 순희 -가 누구-에게 책 한권 -을 선물했어?

Soonhi-ga nugu-ege chaek hangweun-eul sunmulhaesseu?

Soonhi to whom book a present? (To whom did Soonhee give a book?)

유리에게 순희가 책 한권-을 선물했지.

Yoori-ege Soonhiga chaek hangweun-eul sunmulhaetjji.

To Yoori, Soonhee gave a book.

In addition, the functional category M(Modesty): the speaker's respect for the listener) is outside syntax, thus invisible, while the pre-final ending of ‘-seumni-’(the grammatical form of Modesty) located in the verb of the syntactic structure.

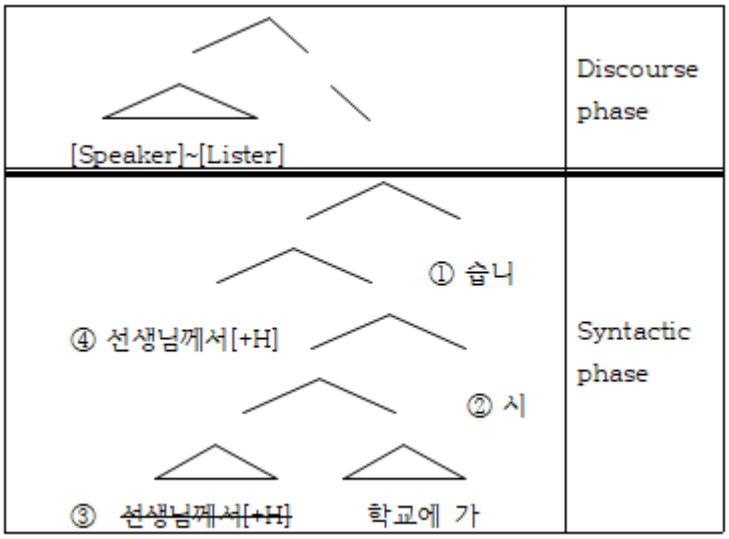
(20) [The speaker(+Humble)] 선생님-께서 학교-에 가셨습니다. [The listener(+Honor)]

Seunsaengnim-kkeseu hakko-e gasyeutsseumnida.

teacher to school went. (Teacher went to school)

The listener of '-습니-(-seumni-)' did not appear in the sentence structure. It is impossible to determine whether the structure of 'NP께서 학교에 가-' is correct or not, unless the listener and speaker are morphologically realized in the sentence. In other words, it means that '-seumni-' cannot be checked in the process of the syntactic derivation. If the listener who deserves the honor (for example, the speaker's grandfather) in relation to the speaker(me) appears in an out-of-linguistic context, it is correct. On the other hand, in the case of a listener (for example, the speaker's son) who may not deserve the honor, it is incorrect. Therefore, in order to check the grammatical form of '-seumni-', the discourse context outside the language must be considered, not the inside syntax as shown in (20)

(20) The layers of phase



On the other hand, the honorific feature of 'Probe'(the '-si-': ②) can be checked for the one of the 'Goal'(the teacher: ④). Soon, the honorific feature[+H] of 'teacher' moves to the Spec of '-si-' (and also '[+H] of teacher' is deleted in ③), resulting the [+H] of '-si' is deleted by one of '-si-'(Agreement between Probe and Goal), and further, since both the probe '-si-' and the Goal 'Teacher' are inside syntax of 'C_{HL}'. unlike'-seumni-'. Again back to '-seumni-', the modesty feature[+M] of it as the probe agrees with the feature of the discourse outside the syntax, and the Probe-Goal chain is discourse phase. Therefore, if the (N) is a category of LIs' that would be handled in syntax required for the operation of syntactic C_{HL}, the discourse

objects such as 'speaker' and 'listener', etc., are not suitable for the elements of the (N) because they do exist beyond as a pragmatic C_{HL}. This means that the 'speaker' and 'listener' themselves should be included in a set different from the (N). In other words, it is necessary to carefully reconsider putting forcibly functional categories of DO's into a (N) set in that a configuration of the agreement between the features of the LI and DO's can go beyond the syntactic phase, while a configuration of agreement between the features of the LI and the grammatical features corresponding to the LI is inside the phase of the maximal it.

If so, is it possible to harmonize 'Inclusion Condition' mapping the discourse phase over the maximum SO without contradiction? There are two ways that 'Object' becomes to be legally checked without violating the inclusion condition.

First, as mentioned in the previous section, assigning functional categories such as C, T, I to visible LIs has an inherent peculiarity to function probe. However, it has a circular contradiction in that it is possible to grasp the validity of the existence of the functional category as inherent LIs only by referring to the completed derivation after the agreement operations were carried out in the syntactic department. Further, this condition again does not apply to structures like Top or Foc because it is limited to the maximum syntactic one. If so, here, in addition to the (N), we can provide a separate space for dealing with 'discourse model, situational knowledge, encyclopedia knowledge, etc.' presented in a model structure such as Levelt (1992:1-22). It means a space for the cognitive perspective to the real world before the speakers' thoughts are implemented in language.

I suggest setting up an independent space for the so-called discourse set (Discourse (N), hereinafter referred to as DN) that separately selects them directly involved in sentence generation(among those cognitive constituents)-likewise a set of functional categories putting on worktable , and there are discourse functional categories such as 'Top And Foc, etc'. It can be seen as similar to the property of (N), which is a working space for LIs selected from lexicon before the syntactic C_{HL}. It is quite cautious, but this is independent in that, the speaker takes not only the operation on the proposition itself, but also the information structure that considers the relationship between the listener and the speaker in order to achieve linguisticalization for a pre-linguistic message (the event itself).

The speaker thinks of not only the proposition itself but also the information structure. And in principle, the (N) should be composed of tangible elements, not intangible ones. In this respect, it is possible to find the justification for DN, a set of independent functional categories for discourse, Furthermore, the phase can be expanded in that the speaker first considers the context of use such as the tense aspect, attitude aspect, mode, and mood for a proposition (event), and then refers to (N) to enter into C_{HL}. As can be seen, C, T, I, etc., which are the outputs of the theory inner product of the syntax, can also be viewed as elements of the discourse selection set (DN). Taking the 'tense' as an example, it is as follows.

(21) 가. 비가 오겠다. Bi[rain]-ga o[fall]-get[+Future]-ta.

나. 비가 왔었다. Bi[rain]-ga wa[fell]-eut[+Past]-ta.

다. 비가 온다. Bi[rain]-ga o[fell]-n[+Present]-ta.

The target(=Goal) of the Probe '-겠-(-get-) in '비가 오겠다' cannot be found in the syntactic structure. The probe's goal is checked from the objects in DN. The same is true for tense features such as '-왔었-,-is-'. These only morphologically check the nominative case in Korean. Strictly speaking, it must check beyond the sentence that the proposition (event) has happened in the past. Furthermore, assuming that '-습니-' is a head for discourse phase, the ending '-다' which agglutinates to Vst at the final should also be a head for it in a logical way. The reason is that '-다-' is followed by '-습니-'. If '-다-' is the head for the syntax phase while '-습니-' is a discourse one, we have no choice but to violate the 'Subjacency Condition'.

If functional categories such as T, H, do not exist in the discourse phase, we cannot explain the sentence to be incorrect because the functional operation is inactive if there are no functional categories in (N). I will demonstrate this point with a structure below.

(22) *선생님께서 온다.

{오, ㄴ, 다}

Seonsaengnimkkeseo onda.(Teacher is coming.)

{on, n, da}

come current tense final ending

The functional feature [+t] of the n(ㄴ) remains in LF not to be checked. As the result, the structure is not converged if we do not acknowledge that the functional category [+T] exists independently. Therefore, we can derive the logical conclusion that the functional category should exist independently regardless of the features of LIs' in the lexicon.

In conclusion, the target must exist in the discourse phase, and the functional category is not an element of (N) in syntax. If so, the result of this discussion raises the need for a separate space called the discourse (N) (hereafter referred to as (DN)), as discussed above. However, what and how many of these functional categories could exist has not been discussed in this paper. What is clear is that the functional category is not a property to fit into the (N), but

there is a property to fit into a separate space (DN). The brief summary of the above discussion is as follows.

(23) Discourse Numeration {Functional Categories C, T, I, Top, Fos.....}

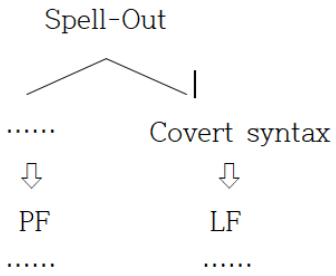
⇩

Numeration {Lexical Items}

⇩

Overt syntax

⇩



V. Conclusion

This paper aimed at clarifying the functions and roles of the Numeration assumed in the Minimalism and what categories are included in the elements of the Numeration. In the case of the functional categories, since taking on invisible forms, those categories may not be accounted for in the theory of minimalism which deals with only visible forms. This paper clarifies that the numeration is a set of LIs' as an arrays on the worktable for C_{HL} in which only those necessary for the operation of syntax to derive a correct structure are selected. It participates in C_{HL} sometimes with an integration of features, sometimes with separated features. This operation is ultimately intended to act as a suitable interpretation that converges in the PF and LF. An element of (N) consists of a pair of (LI, *i*) in which LI is a lexeme and *i* is the index of how many times of the LI is used to participate in C_{HL}. The process of the operation, which generates a syntactic object at each level of $C_{HL,}$ will not stop until the index is reduced to zero.

This operation is ultimately intended to make the syntactic object a suitable interpretable structure that matches in PF and LF. The (N) provides the LIs' for a deriving structure that determines the reference set and the cause of the features' check. Furthermore, the current

article explains with some examples of Korean that the (N) also works as a criterion for determining which is the correct or not among competitive derivations. This set of (N) is used as materials for the minimal computation of derivation and prepares the basis for a very limited basic operation in the external and internal movements of the syntax. Examples of the operation of the (N) include Select, Merge, Move, and Agree. Next, it was argued that the functional category should be arrayed in a separate space called discourse numeration((DN)) because it serves as a discourse-level information structure rather than as an (N) for syntactic C_{HL}. For example, in Korean, the functional categories 'Top, Foc' in the information structure level such as 'topic' and 'focus' should be checked at the information structure level. These categories correspond to the phases of "discourse model, situational knowledge, encyclopedia knowledge, etc." presented in the module of Levelt (1992:1-22). This can be seen as similar to the (N), which is the space of an operation system for the working LIs' selected from the lexicon before a syntactic object enters the computational process.

Furthermore, since functional categories, such as C, T, and I, have a check relationship in a phase beyond the sentence dimension, the possibility of expanding these functional categories to elements of the discourse selection set was also carefully presented. With this assumption, as shown below, the discourse selection set should be constructed before (N) is constructed. Furthermore, the functional categories have a checking chain in the phase beyond the syntactic level. Therefore, it was suggested that these functional categories should also be incorporated as elements of the (DN). With this assumption, the (DN) must exist independently before the (N) is constructed, as shown below.

Discourse Numeration {Functional Categories C, T, I, Top, Fos.....}

⇩

Numeration {Lexical items}

⇩

.....

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