The Interaction of Syntax with Morphology and the Lexical Integrity Principle*

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1. Introduction

In the context of generative grammar, the discussion of the notion of word has centered around the question of whether a component devoted to word formation exists. For example, Chomsky (1970) argues for the presence of a word formation component by pointing out the syntactic differences between gerunds and derived nominals. The view that a word formation component exists is called the *Lexicalism* and there have been a lot of followers including Selkirk (1982), Di Sciullo and Williams (1987), Di Sciullo (2005), etc. In the Lexicalism, the word is formed in morphology or lexicon. Words created in the component turn out to be inputs for syntax, which uses words to build phrases. In contrast to the Lexicalism, a theoretical view that does not admit a word formation component is called the *Constructionism* (Fábregas and Scalise (2012)). In this view, word structure is built in syntax, which is the only generative component. In the Constructionism, there are two possibilities with respect to the status of morphology. One possibility is that there is no morphology as a generative component and the other one is that morphology is an interpretive component that modifies or changes input structure from syntax. One of the theories established on the basis of the latter possibility is Distributed Morphology (Halle and Marantz (1993, 1994), Marantz (1997, 2001, 2007), Embick and Noyer (2001, 2007), Embick and Marantz (2008), Embick (2010, 2015)).

The difference in the status of morphology leads to the difference in empirical prediction; in the Lexicalism, there are no syntactic operations that affect the internal composition of words, while in the Constructionism, internal parts of words are visible to syntax and then, syntactic operations can affect the internal structure of words. The view of the Lexicalism considers morphology or lexicon to be the word-formation component. This component builds words and sends them to syntax. Syntax does not care how they are composed or what are in them. It only needs labels of words, such as the information of syntactic categories and argument structure. In contrast, in the Constructionism, there is no word formation components. Every word structure is built in syntax, which means that syntactic operations like movement yield words. For the consideration of the difference in the applicability of syntactic operations for word building, the following data are helpful:

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(1) a. *Truck is what he likes a [_____ driver]
b. Trucks are what he [drives _____]
(Fábregas and Scalise (2012:121))

In (1b), the object *trucks* of the verb phrase *drives trucks* is extracted, while in (1a), the non-head *truck* cannot move out of the compound *truck driver*. This fact demonstrates the opacity of a word-internal element to syntactic operations like movement. This immunity to syntactic operations is called the *Lexical Integrity Principle* (Bresnan and Mchombo (1995)). Given the data relevant to the Lexical Integrity Principle, one might doubt the validity of the Constructionism.

Although the Lexical Integrity Principle is an essential characteristic of a word, the presence of the principle does not immediately deny the Constructionism. In the Constructionism, the Lexical Integrity Principle is not a principle but a mere effect. If it is just an effect, it can be derived from other methods. Based on the background, this paper takes a position of the Constructionism, particularly the framework of Distributed Morphology, and aims to explain the effect of the Lexical Integrity Principle, as shown in (1).[1] I will argue that the non-extractability of *truck* in (1) is attributed to the interaction of syntax with Morphology in the sense of Distributed Morphology. Syntax delimits a domain where compounding takes place. In particular, I will propose that morphology applies compounding as morphological movement to an independent syntactic chunk called a phase (Chomsky (2000, 2001)).

The rest of this paper is organized as follows. Section 2 first decomposes the Lexical Integrity Principle into two aspects: non-interruptability and non-accessibility. The key factor defining wordness is the former aspect. Then, the rest of section 2 is devoted to the introduction of facts related to non-interruptability and the possible syntactic explanations of them. Section 3 is the introduction of the framework that this paper adopts. The first part of the section introduces the grammatical architecture of Distributed Morphology and shows how to derive compounds. The view of compounding as a morphological movement operation is also introduced (cf. Morita (2016)). The second part of the section is about phases in words. As a specific implementation of phases in words, Embick's (2010, 2015) analysis is adopted. Based on the framework introduced in section 3, section 4 proposes phased-based compounding. Compounding targets at elements included in a phase domain. This interpretation of compounding explains the non-interruptability aspect of the Lexical Integrity Principle, as shown in section 5. Section 6 shows consequences of the view of compounding as a morphological movement operation.

[1] Adopting a view of the Constructionism does not immediately denies the Lexicalism. To discuss advantages or disadvantages of the two positions is not the focus of this paper. See Embick and Noyer (2007) for the theoretical advantages of Distributed Morphology.

Section 7 concludes this paper.

2. The Lexical Integrity Effects and Possible Syntactic Explanations

The Lexical Integrity Principle is not monolithic. It traditionally consists of non-interruptability and non-accessibility (Booij (2009, 2010)). However, Booij (2009) argues that the defining property of word is dependent only on non-interruptability. Let us show why non-accessibility part is not acknowledged as part of the Lexical Integrity Principle.

According to the non-interruptability part of the Lexical Integrity Principle, the word rejects syntactic manipulations such as the extraction of constituents of a word (Booij (2009:86)). This was already shown in (1).

The denial of syntactic deformation observed in (1a) implies the strong cohesiveness of between word parts. This implication does not however indicate that word-internal constituents are invisible to syntax (contra Anderson (1992)).[2] Booij (2009:90) argues with Harris's (2006:206) data of Georgian compounds that in some cases, external elements can modify internal constituents of a word:[3]

(2) a. Sam tit-moč'r-il-i (k'aci)
three.OBL finger-cut.off-PTCPL-NOM man.NOM
'(a man) with three fingers cut off'

b. or-ze-met' marcvl-ian-i (sit'q'va)
two-on-more.OBL syllable-PROP-NOM word.NOM
'(a word) of more than two syllables'

According to Harris, words in the oblique form in (2) semantically function as the modifiers of internal parts of words. In (2a), *sam* modifies *tit-* of the compound *tit-moč'r-il-i* and in (2b), *or-ze-met'* modifies *marcvl-* of the derivative *marcvl-ian-i*. The data clearly demonstrate that non-accessibility should not be included as an integral part of the Lexical Integrity Principle. Therefore, I will henceforth simply ignore the phenomenon of non-accessibility.[4]

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[2] Anderson's (1992) definition of the Lexical Integrity Principle bans every syntactic operation. Witness the following definition (Anderson (1992:84)):

(i) The syntax neither manipulates nor has access to the internal structure of words.

However, there are examples showing that a word allows the access by syntax to its constituents. See the examples in (2).

[3] Abbreviations used in the data are the following: NOM = nominative, OBL = oblique, PROP = proprietive, PTCPL = past participle

[4] The ignorance of non-accessibility phenomena does not mean that we do not have to explain such phenomena. The modification of word-internal constituents by external modifiers is not cross-

As we observed in (1), any constituent of a word cannot be extracted from the unit. For this phenomenon, many explanations from the various perspectives have been put forward. One of the explanations is given from the position of the Constructionism; the Lexical Integrity Principle is an epiphenomenon occurring as a result of the interaction of syntactic operations with certain constraints. The next subsection will be devoted to this topic.

2.1. Movement of Heads + the Chain Uniformity Condition = Non-Interruptability?

Ackema and Neeleman (2002:100-101) suggest a possibility that movement of a constituent of a word to some word-external position is prohibited because it violates the Chain Uniformity Condition (Chomsky (1995a:253)), according to which "a chain is only well-formed if every copy in it is uniform with regard to phrase structure status." The condition severely limits the possibility of syntactic movement. For example, if the head constituent X^0 moves somewhere, it must move to a higher head position but not to a higher phrasal position. Hence, the movement of *wat* and *pruimen* in (3b) and (3c) is banned because the X^0 elements move to phrasal positions like Spec-CP, which is the violation of the condition. Witness the following data from Dutch:

(3) a. Dit is een [pruimen boom]
this is a plum tree
b. *Wat is dit een [t boom]?
what is this a tree
c. *Pruimen is dit een [t boom]!
plum is this a tree
(Ackema and Neeleman (2002:100))

The present explanation appears to work well. However, Ackema and Neeleman claim that it is theoretically flawed because the recent development of Minimalism disallows the syntactic distinction between X^0 and XP (Chomsky's (1995b) Bare Phrase Structure theory). Moreover, even if one might admit the distinction between

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linguistically acceptable. Witness the following Japanese data:

(ii) *taihen [$_N$ kookyuu-hoteru]
very [$_N$ high.class-hotel]
(Kageyama (2016:491))

In contrast to the external modifiers in (2), the external modifier in (ii) cannot modify word parts. That is, *taihen* cannot modify the non-head adjectival *kookyuu-*. The present data clearly demonstrate that Japanese disallows external modification in question.

morphological and syntactic units and assume that the Chain Uniformity Condition is sensitive to the distinction, it is tantamount to the acknowledgement of the existence of a generative component dedicated to word formation.

Besides the theoretical flaws, the present explanation empirically makes a wrong prediction; a constituent of a word can be extracted if it moves to a X^0 position. This is illustrated with the following examples of N-to-D movement:

(4) a. [$_{NP}$ hans [$_{N'}$ bøker om syntaks]]
his books about syntax

b. [$_{DP}$ [bøke]$_i$-ne [$_{NP}$ hans [$_{N'}$ t_i om syntaks]]
books-the his about syntax

(5) a. [$_{NP}$ hans [syntaks bøker]]
his syntax books

b. [$_{DP}$ [syntaks bøke]$_i$-ne [$_{NP}$ hans t_i]]
syntax books-the his

c. *[$_{DP}$ [syntaks]$_i$-ne [$_{NP}$ hans [t_i bøke]]]
syntax-the his books

(Ackema and Neeleman (2002:101))

Norwegian has N-to-D movement, as shown in (4b), where *bøke* moves to D. This movement does not violate the Chain Uniformity Condition. Therefore, in the language, the movement of word parts to D should be allowed. However, this is wrong. In (5c), the movement of the non-head constituent *syntaks* of the compound *syntaks bøker* is disallowed even though the constituent moves to D, while in (5b), the compound as a whole can move there. If the Chain Uniformity Condition prohibits the movement of a compound-internal constituent, it allows such movement when the landing site is a head position. The data in (5c) shows that the condition in question is not enough to explain the effect of non-interruptability.

2.2. Movement of Heads + the Head Movement Constraint = Non-Interruptability?

With respect to the data in (3b, c) and (5c), Ackema and Neeleman (2002:101) suggest another syntactic explanation; the Head Movement Constraint (Travis (1984)), which states that a head constituent cannot move to another head constituent if there is an intermediate head constituent between the two. Given this constraint, the ungrammaticality observed in (3b, c) and (5c) is explained because the non-heads move over the c-commanding heads.

Although the present explanation seems valid, it is fraught with several problems. One of them is that it yields empirically wrong predictions. The

constraint allows the extraction of the non-head constituent if it is phrasal. According to Ackema and Neeleman (2002:101), this prediction is not borne out:

(6) a. Leo is een [[oude munten] verzamelaar]
Leo is an old coins collector
b. *Wat is Leo een [t verzamelaar]?
what is Leo a collector
c. *Oude munten is Leo een [t verzamelaar]!
old coins is Leo a collector

In (6a), *oude munten verzamelaar* is a compound composed of the phrasal non-head *oude munten* and the head *verzamelaar*. The non-head cannot skip over the head though the former is phrasal, as shown in (6b, c).

One might argue from the present data that the non-head is not a phrase but a lexicalized phrase or a word. Given the lexicalized status of the non-head, one could attribute the ungrammaticality of (6b, c) to the violation of the Chain Uniformity Condition. This explanation can be applied to the present data, but it cannot still capture the data in (5c).

2.3. Non-Interruptability as Islands

One might think from the observations in the previous subsections that syntactic explanations of the effects of non-interruptability are not possible. However, Fábregas and Scalise (2012:146) suggest that the effects can be explained from the viewpoint of syntactic islands from which the extraction of constituents are banned. The examples of syntactic islands are shown below:

(7) We visited the boy at the hospital.
(8) a. Which boy did we visit ____ at the hospital?
b. What a (great) boy we visited ____ at the hospital!
c. The boy we visited ____ at the hospital, not the girl.
(9) a. *Who did [the dog of ____] eat that bone?
b. *What didn't she know [who has read ____]?
c. *Who will Mary talk to John [if ____ asks her to do it]?
(Fábregas and Scalise (2012:145-146))

The data in (7) and (8) illustrate that the phrasal constituent *the boy* can move to the top of the sentences. This movability does not mean that in every case, phrases are movable, as shown in (9). For instance, the data in (9a) displays the function of DP

as a syntactic barrier, which prohibits *wh*-movement. As is observed in (9b) and (9c), there are other types of islands. If the Constructionism's central idea of syntactic word formation is correct, we can employ the notion of island to explain the non-interruptability. Fábregas and Scalise indeed mention this possibility by citing the examples of the non-interruptability given below:

(10) John is a truck driver.
(11) a. *What does John like a ____ driver?
b. *What a (great) truck does John like a ____ driver!
c. *Truck- does 〔sic〕 John like ____ drivers, not train-.
(Fábregas and Scalise (2012:145))

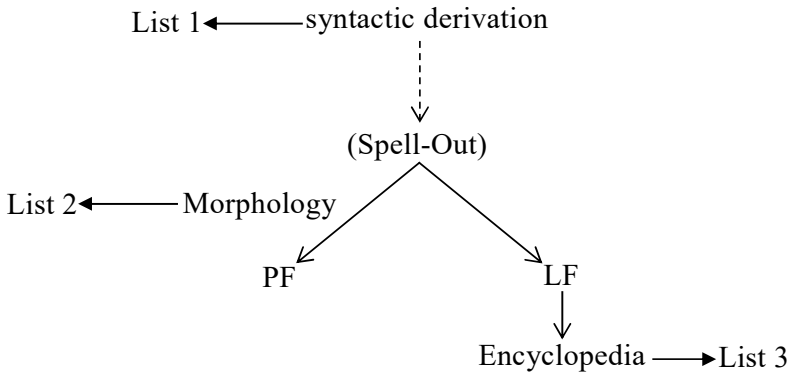
According to them, the fact that the compound in (10) resists any syntactic movement as given in (11) is explained by considering the island status of the complex word. Based on this idea, this paper will formalize it from the perspective of Distributed Morphology and the phase theory, one of the minimalist theories of islands (Chomsky (2000, 2001)).

3. The Framework

3.1. The Grammatical System of Distributed Morphology

As mentioned in section 1, Distributed Morphology, one of the Constructionism versions of morphological theories, does not admit morphology as a generative component. In the framework, word structure is built in syntax. The word building is carried out by referring to features relevant to syntax. These features are called formal features and listed in the storage List 1 (see (12) below). The word structure is sent to Morphology, which is on the way to PF. The component assigns appropriate sound forms or exponents to syntactic structures. Exponents are paired with formal features. These pairs are called vocabulary items and the storage containing them is called List 2 (see (12) below). While changing the word structure into exponents, Morphology modifies it by reordering its parts or adding some elements which are not present in syntax. The former is called Local Dislocation and the latter is called Ornament Morphology. The details of Local Dislocation are given in section 3.3. As mentioned so far, syntax and Morphology are responsible for the formal side of words. The semantic side of words is related to LF and Encyclopedia. LF is a component that interprets structural semantics or regular meanings. On the contrary, Encyclopedia handles conceptual semantics or irregular meanings. The information about conceptual semantics of words is stored in List 3 (see (12) below).

(12)



This paper focuses on the interaction of syntax with Morphology, so that the following sections 3.2 and 3.3 give a somewhat detailed explanation of the mechanisms of the components.

3.2. Building Word Structure

As mentioned above, information related to syntactic operations is stored in List 1. In this list, there are two types of features: one is called Roots such as √DOG, √KICK, and √HOT and the other called functional morphemes such as [det], [pl], and [past]. A Root is a category-neutral morpheme and functions as a label to distinguish lexical items in encyclopedic semantic terms. For example, the two nouns *dog* and *cat* are not syntactically distinguishable but they are semantically different. This is because *dog* contains √DOG, while *cat* contains √CAT, which has different encyclopedic information from that of √DOG. Roots roughly correspond to lexical categories in that they have some semantic contents. However, this does not mean that bare Roots are informative enough to be interpreted in the interfaces like Morphology/PF and LF/Encyclopedia. To be interpreted by these interfaces, Roots must be categorized by categorizers, which assign lexical categories like noun, verb, and adjective to Roots. The category assignment is done by referring to syntactic environments where a Root occurs (Harley and Noyer (2000)). Take the noun *dog* for example.

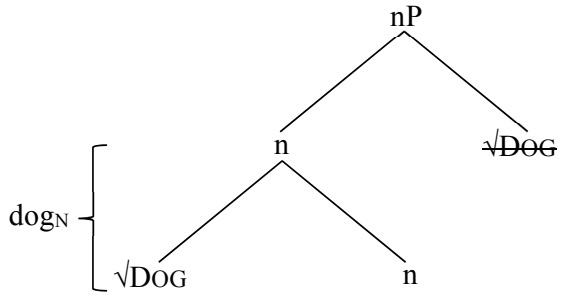
(13) [n √DOG]

In (13), the Root √DOG occurs within the domain of n, which results in the categorization of the Root as a noun at Morphology. Although the sound form of the nominalizer in (13) is null, categorizers are sometimes realized by overt suffixes like *-er*, *-ize*, and *-ic*. For instance, *demonize* includes v and this categorizer is

realized by *-ize* at Morphology.

The representation in (13) is the syntactic structure of the noun *dog*, which clearly indicates that even simplex items like *dog* have a complex structure. As shown in (13), there is no primitive notion of word. Whether simplex or not, a word is always derived through several operations. In Distributed Morphology, a unit corresponding to one word is a complex head composed of multiple terminal nodes (Embick and Marantz (2008:7)). In (13), the movement of √DOG into n leads to the complex terminal node that corresponds to the noun *dog*. This complex terminal node is represented as the tree diagram in (14).

(14)



3.2.1. Roots that Select Their (Internal) Arguments

As mentioned above, bare Roots cannot contribute to semantic and morphophonological interpretations. In addition, they are invisible to syntactic labeling (Chomsky (2015)). Given that elements which do not make any contributions to syntactic computation cannot be used (Marantz (1996)), there must be reasons for Roots to be used in syntax.

To deal with this issue, Harley's (2009) analysis is useful. Based on the contrast below, Harley argues that some Roots directly merge with their internal arguments:

(15) a. ?*The student of chemistry and this one of physics sit together.
b. That student with short hair and this one with long hair sit together.
(Harley (2009:134))

The contrast in (15) indicates that the nominal *student* which takes its argument cannot be replaced with the anaphor *one*, while it can when the nominal is joined with an adjunct. In (15a), the arguments are *chemistry* and *physics* and in (15b), the adjuncts are *with short hair* and *with long hair*. According to Harley, the difference is associated with the argument-taking property of Roots. Taking into consideration

the fact that encyclopedic semantics is necessary to differentiate an event requiring an internal argument from one without such argument, Harley proposes that Roots can take (internal) arguments. The structures of the nominal with its argument and that without an argument are shown as follows.[5]

(16) a. [$_{nP}$ [$_{n}$ √STUD$_i$ n] [$_{√P}$ ~~√STUD$_i$~~ [$_{DP}$ chemistry]]]
b. [$_{nP}$ [$_{nP}$ student] [$_{PP}$ with short hair]]
(Harley (2009:134-135), with slight modifications)

In (16a), √STUD first merges with DP and moves to n. In contrast, in (16b), after the Root is nominalized, the resultant nP is merged with PP. The syntactic difference leads to the difference in the number of nPs. In (16a), there is only one nP, while in (16b), there are two nPs. Given Harley's (2009) assumption that an nP can be the antecedent of anaphoric *one*, there are two positions replaced with *one* in (16b), in contrast to (16a). If the anaphor is used to replace with *student* in (16b), (15b) is obtained. On the contrary to (16b), (16a) has only one position replaced with the anaphor and then, there are no choice but for the anaphor to refer to the whole structure (cf. (15a)).

3.2.2. The Definition of Compounds

Given the syntactic reinterpretation of word, Harley (2009:130) defines a compound based on the framework of Distributed Morphology:

(17) Compound: A word-sized unit containing two or more Roots.

In (17), 'a word-sized unit' means 'a complex terminal node'. Therefore, the definition indicates that a complex terminal node is interpreted as a compound at the interfaces if the unit contains two or more Roots. Whether a unit is a compound is decided at Morphology. A syntactic structure built out of two or more Roots and a set of functional morphemes is sent to Morphology. At this component, it is modified by some morphological operations, as a result of which a compound emerges.

3.3. Local Dislocation

As mentioned in section 3.1, Morphology modifies input structures to a certain degree. One of the modifications performed by Morphology is reordering or *Local Dislocation*. The targets of Local Dislocation are elements that are assigned morphological and phonological information by Vocabulary Insertion (Embick and

[5] *Of* is a morpheme inserted at Morphology to meet the Case requirement of the DP *chemistry*.

Marantz (2001)). In addition to Embick and Noyer (2001), who argue that Local Dislocation is available only after syntactic elements are spelled out as sound forms, Adger (2006) suggests that the operation takes place before the spelling-out operations. Another property of Local Dislocation is that the targets of the operation must be local or adjacent. If there is an intervener, say Z, between the constituents X and Y, Local Dislocation cannot apply to X and Y. To clarify this property of Local Dislocation, witness the following data from Embick and Noyer (2001:56):

(18) a. Mary is the mo-st amazingly smart person …
b. *Mary is the *t* amazingly smart-est person …

The contrast in (18) indicates that the superlative form of the adjective *smart* is derived by Local Dislocation, because if some type of movement which is not sensitive to adjacency created the superlative form, *smartest* would occurr in (18b).

3.3.1. Compounding as Local Dislocation

Morita (2016) argues for the view of compounding as Local Dislocation.[6, 7] As a result of this operation, separate terminal nodes are combined into a zero-level category. According to Morita, synthetic or deverbal compounds like *claw removal* are derived as follows:

(19) Syntactic structure: $[_{DP}$ D $[_{\sqrt{P}}$ $\sqrt{}$REMOVE $[_{nP}$ claw$]]]$
(20) Morphological structure
a. $[_{DP}$ D $\boxed{[_{\sqrt{P}}\ \sqrt{}\text{REMOVE}\ [_{nP}\ \text{claw}]]}]$ → $[_{DP}$ D $[_{N}$ removal $[_{N}$ claw$]]]$
b. $[_{DP}$ D $\boxed{[_{N}\ \text{removal}\ [_{N}\ \text{claw}]]}]$ → $[_{DP}$ D $[_{N}$ claw removal$]]]$

(Morita (2016:56), with slight modifications)

In (19), D selects √P (Morita's LP) which selects nP, the syntactic structure of *claw*. The structure as a whole is sent to Morphology. The component first categorizes the √P as N because the category-neutral complex element is c-commanded by D, one of the nominalizers, as shown in (20a). After this categorization, Morphology adds the nominal suffix *-al* to *remove*. Next, Morphology switches between *removal* and *claw* according to a condition on ordering; in English, the syntactic head is initial, while the morphological head is final. According to this constraint, Morphology

[6] Notice that Morita does not use the term Local Dislocation to name the operation to lump together separate elements. However, considering that he thinks that the operation in question is sensitive to adjacent elements (Morita (2016:56)), I use Local Dislocation as the name of the operation.

[7] From the analysis of Morita, it is not clear to me whether Local Dislocation applies before or after syntactic features are transformed into exponents.

exchanges the head constituent *removal* and the non-head constituent *claw*, as given in (20b).[8]

3.4. The Notion of Phase in Distributed Morphology

As we have observed so far, in Distributed Morphology, properties of a word are dispersed among the three lists and syntax is the first place of word formation. Syntax picks out materials from List 1 to build a word structure. This does not mean that word formation is carried out seamlessly. Syntax is efficient component. It periodically sends its building blocks to the interfaces. The domains sent to the interfaces are called *phases* (Chomsky (2000, 2001)). The notion of phases, if syntax is responsible for word formation, can be extended to the word domain. Based on this background, Marantz (2001, 2007) and Embick (2010, 2015) argue that there are phases in words. Embick (2010, 2015) argues with Marantz (2001, 2007) that phases in words are delineated by categorizers.[9]

(21) Category-defining heads such as n, v, a, and so on, are cyclic heads; such heads define the phases that trigger Spell-Out.

(Embick (2010:51))

According to (21), morphological or semantic domains are defined by categorizers. The statement implies that functional morphemes other than categorizers are non-phase heads and hence, do not trigger spell out. Given this difference, Embick (2015) defines phase domains as follows.

(22) a. Assumption 1: When a cyclic head is merged, it is a trigger that causes cyclic domains in the complement of that head to be spelled out. So, if *x* is a cyclic head, *x*'s cyclic domain is spelled out only when higher cyclic *y* is merged.

b. Assumption 2: The domains that are spelled out are defined around cyclic heads and their attendant material. A domain defined by cyclic *x* includes (i) *x* itself; and (ii) non-cyclic heads between *x* and the cyclic trigger *y*; it **does not** include the cyclic *y* that triggers spell out of *x*.

(Embick (2015:181))

[8] Morita does not explain the reason why the structure is regarded as a compound. In this paper, the reason is obvious because as the morphological structure in (18b) shows, there is a complex terminal node with two Roots (cf. (15)).

[9] Spell-Out in (18) is an operation that takes away syntactic features to other components. 'Cyclic' of cyclic heads is similar to the notion of phase. Hence, I will use 'phase' heads instead of 'cyclic' heads.

To clarify the workings of Embick's phase theory, take the following sample structure as an example.

(23) [[[Root x] Z] y] ('Z' = non-phase head)

There are two phase heads in the structure. According to (22a), the higher one y triggers Spell-Out and the phase domain delineated by x is sent to the interfaces. According to (22b), the spelled-out domain contains Root, x, and Z. Hence, the three constituents undergo morphological and semantic operations. What is important here is that they are in the same domain. This means that they refer to each other for morphological and semantic information. Embick (2010, 2015) validates this by nominalization and past tense forms in English. Let us introduce each case in turn.

3.4.1. English Nominalization

There are two types of nominalizing suffixes, as shown in (24). The forms of the suffixes in (24a) vary with respect to the bases and the meaning of each derived nominal is somewhat opaque. For instance, the suffix for the derived nominal of *marry* is *-age* but not other suffixes like *-ion* and *-al*. Moreover, *marriage* means not only 'the act of marrying someone' but also 'the relationship between a married couple.' Contrary to derived nominals, the form of the suffix creating gerunds in (24b) is invariable regardless of bases and the meaning of a gerund is compositional (for example, the meaning of *marrying* is 'the act of marrying').

(24) a. Derived nominal: marri-age, destruct-ion, refus-al, confus-ion
b. Gerund: marry-ing, destroy-ing, refus-ing, confus-ing
(Embick (2015:180))

The differences in form and meaning between the two types are attributed to the differences in structure. The derived nominal is built by the direct merge of a Root with a nominalizer, as shown in (25a). When attached to a Root, a nominalizer triggers Spell-Out and the structure is sent to morphology and LF/Encyclopedia.[10] At the interfaces, n can refer to the morphological or phonological information specified in the Root because the two elements are in the same domain. In contrast, the gerund has more complex structure. First, a Root is combined with a verbalizer and second, the resulting structure merges with a nominalizer. Note that there are two phase domains: the domains defined by a verbalizer and a nominalizer. The

[10] When the difference between LF and Encyclopedia does not matter, I use "LF/Encyclopedia."

presence of two phase domains implies that one of the constituents included in a phase domain cannot be used for morphological or semantic computations of another phase domain because the attachment of the higher phase head to the structure leads to the Spell-Out of the domain defined by the lower phase head. In (25b), the nominalizer cannot hence refer to the Root, which means that the nominalizer must select a default form and meaning.

(25) a. The structure of (24a): [√ROOT n]
b. The structure of (24b): [[√ROOT v] n]

(Embick (2015:180))

3.4.2. Irregular Past Tense Forms

Some words show that phase-external elements can consult phase-internal elements:

(26) a. leave → left
b. hit → hit
c. kick → kicked

In English, some verbs take irregular past tense forms like (26a) and (26b). The structure of verbs is schematized as follows:

(27) [[√ROOT v] T]

At first sight, [past] on T cannot apparently refers to the Root because v creates a phase domain where it functions as a barrier to T. However, recall that (22b) states that non-phase heads attached to a phase head are spelled out together. With this in mind, then, it is not surprising that T shows a form with respect to a Root because the two morphemes are in the same domain.

So far, we have observed the framework of Distributed Morphology and Embick's (2010, 2015) version of phase theory. Based on these, the next section proposes the view of phase-based compounding.

4. Proposal

4.1. The Syntactic Structure of Compounds

In this paper, I adopt Harley's (2009) proposal that bare Roots select for categorized Roots (see section 3.2.1 for more detail) and suggest that compounds have the following syntactic structure.

(28) $[_{yP}$ y $[_{\sqrt{P}}$ $\sqrt{\text{ROOT}}$ $[_{xP}$ [x $\sqrt{\text{ROOT}}$]]]]

The structure in (28) is built out of two Roots. It is hence interpreted as a compound at the interfaces. The non-head Root is categorized by the categorizer x. The resultant structure is selected by a Root, as shown in (28). Although the higher Root in (28) does not have a certain lexical category, it is categorized at the interfaces by referring to syntactic environments where the Root occurs. For example, if √P is selected by n or D, it is categorized as N at the interfaces. Due to the argument-selecting nature of Roots, the structure in question can be extended to every type of compounds, as Harley (2009) shows. According to Harley, not only synthetic compounds but also compounds made only of simple nouns such as *nurse shoes* have the structure. Given this background, I do not make any differences among compounds in structural terms.

4.2. The Morphological Structure of Compounds

The structure in (28) is sent to Morphology and transformed into a morphological structure. In this paper, I adopt Morita's (2016) view of compounding as Local Dislocation and argue that the operation applies to the structure in (28). Let us explain the working of this process in detail by taking *doorknob* as an example.

(29) a. Syntactic structure: $[_{nP}$ n $[_{\sqrt{P}}$ $\sqrt{\text{KNOB}}$ $[_{nP}$ [n $\sqrt{\text{DOOR}}$]]]]
b. Determining categories and exponents: [-Ø [knob$_N$ [-Ø door$_N$]]]
c. Ordering 1: [-Ø [knob$_N$ [-Ø door$_N$]]] → [-Ø [knob$_N$ [door$_N$-Ø]]]
d. Ordering 2: [-Ø [knob$_N$ [door$_N$-Ø]]] → [-Ø [[door$_N$-Ø] knob$_N$]]
e. Ordering 3: [-Ø [[door$_N$-Ø] knob$_N$]] → [[door$_N$-Ø] knob$_N$-Ø]
f. Compounding: $[_N$ doorknob]

After the syntactic structure of *doorknob* is built, it is sent to Morphology. The first task of this component is to categorize Roots. Based on the syntactic environment, the Roots in (29a) are categorized as N, as shown in (29b). According to their categories, the Roots are respectively assigned the exponents *knob* and *door*. In addition, the two n's are realized as null suffixes. The second task of the component is to determine the linear order. To explain the mechanism of ordering, let us make three assumptions. The first assumption is that an element selected by a null or overt suffix is interpreted as a morphological word. Based on this assumption, *door* and the complex structure [knob$_N$ [-Ø door$_N$]] turn to be morphological words. The second assumption is that a morphological word must not be built out of a phrase (cf.

Botha's (1981) No Phrase Constraint). This assumption enables us to consider that $knob_N$ of the complex structure [$knob_N$ [-Ø $door_N$]] to be a morphological word since the complex structure is also a morphological word. The third assumption is that in English, the head of a word is final (cf. William's (1981) Right-Hand-Head Rule). Based on the three assumptions, the correct linear order is obtained. In (29c), an ordering operation first applies to the structure [-Ø $door_N$]. This structure is transformed into a suffixed word. As a result, the null suffix and $door_N$ must be switched on the basis of the Right-Hand-Head Rule. In (29d), the ordering operation targets at the complex structure [$knob_N$ [$door_N$ -Ø]]. Due to the categorization by Morphology, it is converted into a morphological word made out of two morphological words. Based on the fact that $knob_N$ selects for $door_N$-Ø, the former word is the head of the complex structure. Hence, the positions of the two words must be switched according to the Right-Hand-Head Rule. The targets of the ordering operation in (29e) are the null suffix taking the structure [[$door_N$-Ø] $knob_N$] and this selected structure. By the operation, their positions must be switched, as the right-hand structure demonstrates. The third task of Morphology to create a compound is combining two morphological words. As a result of this operation, the two morphological words $door_N$-Ø and $knob_N$-Ø are combined into one large morphological word, as shown in (29f).

4.3. Compounding Phase by Phase

After the syntactic structure represented in (28) is built, the portion of the structure is sent to Morphology by spell out. The question is which portion gets spelled out. To show a spelled-out chunk, let us repeat the structure as (30) and the two Assumptions of Embick (2015:181) as (31) for expository purposes.

(30) [$_{yP}$ y [$_{\sqrt{P}}$ $\sqrt{\text{ROOT}}$ [$_{xP}$ [x $\sqrt{\text{ROOT}}$]]]]

(31) a. Assumption 1: When a cyclic head is merged, it is a trigger that causes cyclic domains in the complement of that head to be spelled out. So, if *x* is a cyclic head, *x*'s cyclic domain is spelled out only when higher cyclic *y* is merged.

b. Assumption 2: The domains that are spelled out are defined around cyclic heads and their attendant material. A domain defined by cyclic *x* includes (i) *x* itself; and (ii) non-cyclic heads between *x* and the cyclic trigger *y*; it **does not** include the cyclic *y* that triggers spell out of *x*.

First, as shown in (30), the phase head x is merged with $\sqrt{\text{ROOT}_1}$. According to

Assumption 1, which states that phase domains in the complement of a phase head are sent to the interfaces, this is the timing of spell out. However, there is no spell out at this point because the complement of x, $\sqrt{\text{ROOT}_1}$, does not contain any phase domains. Next, $\sqrt{\text{ROOT}_2}$ is combined with xP, as given in (30). Although xP corresponds to a phase domain, it is not spelled out because Roots are non-phase heads. Third, the phase head y is merged with $\sqrt{\text{P}}$. According to Assumption 1, y performs the spell out of the phase domain defined by x since y corresponds to the higher phase head. Based on Assumption 2, a spelled-out phase domain must consist of a phase head and non-phase heads between the head and the higher phase head. In (30), the phase head x, $\sqrt{\text{ROOT}_1}$, and $\sqrt{\text{ROOT}_2}$ are included in the spelled-out phase domain. Hence, the spelled-out domain can be illustrated as follows.

(32) $[_{\text{yP}}\ \text{y}\ \boxed{[_{\sqrt{\text{P}}}\ \sqrt{\text{ROOT}_2}\ [_{\text{xP}}\ [\text{x}\ \sqrt{\text{ROOT}_1}]]]}]$
Spell-Out

The boxed part in (32) is the spelled-out domain. A theoretical problem of the scheme is that in the domain, y is not included, which leads to a situation where $\sqrt{\text{ROOT}_2}$ cannot be categorized at the interfaces. To avoid this unwanted situation, I assume that Morphology waits for the higher phase head y to come in order to compute the spelled-out domain.

5. Decomposing the Effects of Non-interruptability

As shown in section 2, a compound is opaque to syntactic movement. For expository purposes, let us repeat (3) and (11) as (33) and (34), respectively:

(33) a. Dit is een [pruimen boom]
this is a plum tree
b. *Wat is dit een [t boom]?
what is this a tree
c. *Pruimen is dit een [t boom]!
plum is this a tree

(34) a. *What does John like a ____ driver?
b. *What a (great) truck does John like a ____ driver!
c. *Truck- does John like ____ drivers, not train-.

The reason why word-internal parts cannot be extracted is explained by the phase-based account of compounds and the view of compounding as Local Dislocation.

For example, in (34a), the compound *what-driver* includes *what* as its non-head. According to Radford (2004:sec.6.4), *wh*-elements are attracted by the *wh*-feature of C, as a result of which the feature gets deleted. The feature is an uninterpretable feature, so the derivation will crash if the feature is not deleted. This property of *wh*-features enables us to explain the ungrammaticality of the example in (34a).

(35) a. $[_{nP}$ n $[_{\sqrt{P}}$ √DRIVE [what]]]
b. $[_{CP}$ $C_{[WH]}$ $[_{TP}$ T $[_{vP}$ *v* [what-driver]]]]

(35a) and (35b) respectively represent the structures of *what-driver* and (34a). In (35b), C's wh-feature must be deleted by *what*. However, as already shown in section 4, the compound in (35a) is spelled out and does not exist in the derivation. Hence, the feature remains intact, which leads to the crash of the derivation at the interfaces. One might say that the extraction of the non-head is possible if it moves to n in (35a) because the head is not included in a spell-out domain (cf. (31b)). However, this possibility is rejected by the view of compounding as Local Dislocation. Suppose that *what* in (35b) moves to the spec of C through the specs of other functional projections like *v*P and TP and deletes the uninterpretable feature [WH].

(36) $[_{CP}$ what $C_{\text{~~[WH]~~}}$ $[_{TP}$ T $[_{vP}$ *v* [~~what~~ driver]]]]

The derivation in (36) is legible at the interfaces. Morphology tries to apply compounding to the structure. However, there is an insurmountable problem. Given that compounding in the present sense is regarded as Local Dislocation and Local Dislocation only affects adjacent elements, *what* and *driver* cannot be compounded into one complex unit. The same arguments hold for the cases in (34b) and (34c). The complex expression *what a truck driver* in (34b) is already spelled out when C is introduced to the derivation, so that C cannot attract the *wh*-element *what a truck*. Even if the *wh*-element escapes from spell out and it moves to the spec of C, the compound *what a truck driver* cannot be derived because *what a truck* and *driver* are not adjacent. In (34c), there are no *wh*-elements. However, *truck* is focused and preposed. According to Radford (2004:sec.9.2), focused constituents must move to the spec of C to delete the uninterpretable feature [FOC] of C. Hence, if the feature is not deleted, a derivation is illegible at the interfaces. However, in (34c), the focused constituent *truck* does not exist in the derivation when C enters into the derivation. The [FOC] feature cannot be deleted, which leads to the crash of the derivation. Although the focused constituent can escape from spell out if it moves to a phase head, the example in (34c) still remains ungrammatical. In the situation,

the constituent must move to the spec of C. Morphology applies Local Dislocation to the constituent *truck* and *driver* to create a compound. However, the two constituents are so far that they cannot undergo Local Dislocation.

In sum, the effects of non-interruptability are explained by the interaction of syntax with Morphology. The next section will show the consequences of the present proposal.

6. Consequences

6.1. Recursive Compounds

In this paper, I have argued for the view of compounding as Local Dislocation. As already mentioned in section 3.3, Local Dislocation is sensitive to adjacency. Two elements are affected by the operation only when they are adjacent. In addition, this paper assumes that if Morphology cannot interpret a syntactic structure because the structure lacks enough information, the component waits for more syntactic information to be sent. Given this assumption and the condition on adjacency, we can conceive of one possibility of compounding.

(37) $[\ldots]_{PH1}\ [\ldots]_{PH2} \rightarrow [_{Z0}\ [\ldots]_{PH2}\ [\ldots]_{PH1}]$

In (37), there are two phases, each of which is respectively represented as PH_1 and PH_2. First, the syntactic structure that corresponds to PH_1 is built and sent to Morphology. This component tries to interpret the structure, but the phase domain lacks sufficient information, for instance, the information about categorization. Morphology hence awaits syntactic features that help its computations. Second, PH_2 is sent to Morphology. It has information enough for the component to carry out its computations. PH_1 and PH_2 are adjacent, so that they can be lumped together by compounding, as shown in (37). Let us explain this procedure in more detail.

(38) a. PH_1: $[_{zP}\ z\ [_{\sqrt{P}}\ \sqrt{ROOT_3}\ [_{yP}\ y\ [\![_{\sqrt{P}}\ \sqrt{ROOT_2}\ [_{xP}\ [x\ \sqrt{ROOT_1}]]]\!]]]]$

b. PH_2: $[_{zP}\ z\ [\![_{\sqrt{P}}\ \sqrt{ROOT_3}\ [_{yP}\ y\ [_{\sqrt{P}}\ \sqrt{ROOT_2}\ [_{xP}\ [x\ \sqrt{ROOT_1}]]]]]\!]]$

c. PH_3: $[\![_{zP}\ z\ [_{\sqrt{P}}\ \sqrt{ROOT_3}\ [_{yP}\ y\ [_{\sqrt{P}}\ \sqrt{ROOT_2}\ [_{xP}\ [x\ \sqrt{ROOT_1}]]]]]]\!]$

In (38), there are three phase heads, which means there are three spelled-out phase domains, each of which respectively includes $\sqrt{ROOT_1}$ and $\sqrt{ROOT_2}$ and x, $\sqrt{ROOT_3}$ and y, and z. In (38b), the spelled-out phase, represented as a shaded area, contains a Root that cannot be categorized, namely $\sqrt{ROOT_2}$, so that Morphology must wait for another phase domain. However, PH_2, where $\sqrt{ROOT_3}$ and y are included, is not helpful because there is also a Root that cannot be categorized, namely $\sqrt{ROOT_3}$.

After PH_3, where z is included, comes to Morphology, this component can perform its computations.

The procedure given above is associated with the generation of recursive compounds:[11]

(39) [[[towel] rack] designer]

In (39), there are two compounds, one of which is *towel rack* and the other of which is *towel rack designer*. First, *towel rack* is built and second, *designer* is added to the resultant compound, as a result of which the larger compound *towel rack designer* is created. The syntactic structure of the compound is illustrated as follows.

(40) $[_{nP}$ n $[_{\sqrt{P}}$ √DESIGN $[_{nP}$ n $[_{\sqrt{P}}$ √RACK $[_{nP}$ [n √TOWEL]]]]]]

Each phase domain is represented as follows.

(41) a. PH_1: $[_{nP}$ n $[_{\sqrt{P}}$ √DESIGN $[_{nP}$ n $\boxed{[_{\sqrt{P}}$ √RACK $[_{nP}$ [n √TOWEL]]]}]]]

b. PH_2: $[_{nP}$ n $\boxed{[_{\sqrt{P}}$ √DESIGN $[_{nP}$ n $[_{\sqrt{P}}$ √RACK $[_{nP}$ [n √TOWEL]]]]]}]

c. PH_3: $\boxed{[_{nP}$ n $[_{\sqrt{P}}$ √DESIGN $[_{nP}$ n $[_{\sqrt{P}}$ √RACK $[_{nP}$ [n √TOWEL]]]]]}

First, PH_1 is sent to Morphology, but there is lack of information that categorizes the Root √RACK. Second, PH_2 comes to Morphology, as a result of which √RACK can be categorized as N. Due to this categorization, PH_1 and PH_2 are compounded. However, another problem arises here because the Root √DESIGN, which is included in PH_2, cannot be categorized. The problem is solved by PH_3, which contains the phase head z that nominalizes √DESIGN. After this Root is nominalized, compounding applies to the complex [PH_1-PH_2] and PH_3. As a result, the recursive compound *towel rack designer* occurs.

6.2. Ban on Agent Non-heads

As shown above, Morphology stops interpreting syntactic structures in a situation where the structures are defective with respect to, for example, categorization. This means that Morphology is not prohibited from performing its computations if information included in syntactic structures is enough for the component to carry out its computations. The complete syntactic structure is scanned by Morphology and if possible, compounding applies to the elements in the structure. After all computations are done, the resultant sound forms are gone out

[11] Thanks go to the reviewers for a possible extension of my analysis to recursive compounds.

of Morphology, so that even if another syntactic structures come to the component, the elements included in the structures cannot refer to the elements leaving the component. This prediction is borne out by the fact that there are no synthetic compounds whose non-heads are interpreted as Agent.

Selkirk (1982:34-35) points out that the non-head of a synthetic compound cannot be interpreted as an external argument of a verb:

(42) a. *The hours for [girl swimming] at this pool are quite restricted.
b. *There's been a lot of [weather changing] around here lately.
c. *[Kid eating] makes such a mess.

(Selkirk (1982:34))

According to Selkirk, the interpretation of the non-heads as external arguments is disallowed. This fact can be explained given that an external argument is in spec-*v*P and the head *v* is a phase head (Chomsky (2000, 2001)). I assume the structure of synthetic compounds in (42) to be represented as follows. In (42), an introducer of the external argument is represented as *v*.

(43) $[_{vP}\ nP_{EA}\ v\ \boxed{[_{nP}\ n\ [_{\sqrt{P}}\ \sqrt{ROOT}\ [_{nP}\ n\ \sqrt{ROOT}]_{IA}]]}]$

According to Chomsky (2000, 2001), the *v* in (43) corresponds to a phase head. It causes its complement nP represented as the boxed area to be spelled out. Notice that the Roots in the area can be categorized. The two Roots are categorized by nominalizers, which indicates Morphology does not wait for another phase domain. The spelled-out phase domain is interpreted and gone out of Morphology. There is nothing to be used for computations. Therefore, even if the external argument represented as nP_{EA} in (43) goes to Morphology, compounding does not occur.

6.3. Ban on Insertion

One of the merits of my proposal is that it can account for the ban on insertion. Because a compound shows strong cohesiveness between its constituents, any operation that breaks the tie is prohibited. One of the operations is movement, as shown in (33) and (34), and another one is the insertion of modifiers like adjectives:

(44) a. *hotel cheap room
b. *shoe big shop
c. *watch skilled maker

d. *life expensive insurance

(Shimamura (2015:22))

The expressions in (44) are unacceptable because there are adjectives that break the link between the two nouns. For instance, in (44a), the adjective *cheap* modifies the head noun *room* only to intervene the two nouns *hotel* and *room*.

The fact that a word denies insertion is captured by compounding as a type of Local Dislocation. The reasoning is as follows. If compounding is a kind of Local Dislocation, it is sensitive to adjacency. That is, if there is an intervener between the non-head and head constituents, Local Dislocation fails to apply to the latter constituents. Let us clarify this by the following schema.

(45) a. [X Y Z]
b. *[[X Z] Y] or *[[Z X] Y]
(46) [N A N]

In (46), the three constituents belong to the same phase domain and each constituent is composed of a Root and a categorizer. After each constituent undergoes Vocabulary Insertion, compounding occurs. However, compounding of X and Z is disallowed because of non-adjacency of the two constituents. This explains the reason why insertion is disallowed in (44) because as in the morphological structure of the unacceptable compounds in (44), the intervener A prevents compounding from applying to the two Ns.

7. Conclusions

Recent morphological positions can be classified into the Lexicalism and the Constructionism. These two differ in the status of Morphology. In the Lexicalism, Morphology is a generative component dedicated to word formation, while in the Constructionism, it does not exist or is an interpretive component (Fábregas and Scalise (2012:133)). The difference in Morphology between the two positions leads to a different prediction. The Lexicalism predicts that words constitute opaque domains to syntactic operations, while the Constructionism predicts that words are not so much different from phrases. This paper adopted the view of the Constructionism, particularly the framework of Distributed Morphology, and argued that the syntactic structure of a compound is built in syntax although they behave as a barrier to syntactic operations like movement and insertion. In particular, I argued that compounding is a type of Local Dislocation (cf. Morita (2016)), which is one of the morphological operations. This paper simply ignored whether or not syntactic

movement contributes to compound formation (cf. Harley's (2009) incorporation analysis). To discuss whether syntactic movement is needed to create compounds is beyond the scope of this paper.

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