A Syntactic-Morphological Analysis of Nominal Compounds*

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Abstract: The present study investigates the syntactic and morphological properties of nominal synthetic compounds such as *claw removal*/*truck driver*, with the aim of identifying the optimum balance and interaction between syntax and morphology. Focusing on synthetic compounds in English extracted from a large corpus, theoretical analysis of compounding is conducted within an antilexicalism framework. Based on this analysis, the model of "well-distributed" word formation is proposed, in which (i) a compound has an underlying structure parallel to that of its clausal counterpart and accordingly their parallel thematic and semantic properties are uniformly handled in syntax, and (ii) the syntactic output, sent to morphology, is required to be constructed into a word form according to a set of morphological operations and conditions.

1. Introduction

The interaction between syntax and morphology is a central theme of recent studies in the generative framework, and general constraints imposed on the syntax/morphology interface have been proposed. The primary purpose of this study is to define core facets of the syntax/morphology interface by analyzing nominal compounds in the model of Distributed Morphology (DM). After a brief survey of the DM approach in section 2, we will discuss a DM-theoretic analysis of compounds and its problems in section 3. Section 4 will present a new analysis and show how it solves the previous problems.

2. An Antilexicalism Model: Distributed Morphology

Although lexicalism, placing word formation exclusively within the lexicon, had constituted the linguistic mainstream until the mid 1980's (Di Sciullo and Williams 1987), the overall similarity of combinatory rules in word and sentence construction has been revealed. This has brought the rise of antilexicalism, according to which major word construction processes take place outside the lexicon. Three antilexical views are recognizable for the formation of nominal compounds: it

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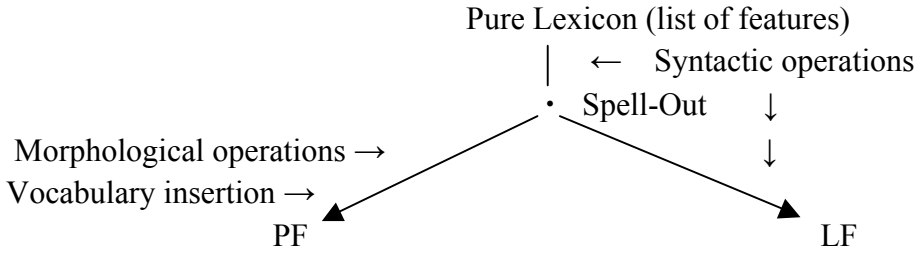
takes place in (i) D-structure construction (Emonds 2000), (ii) syntactic derivation (Lieber 1992), and (iii) syntactic and morphological derivation. The third view is one, which is advanced by DM, whose framework may be schematized in (1) (cf. Halle and Marantz 1994):

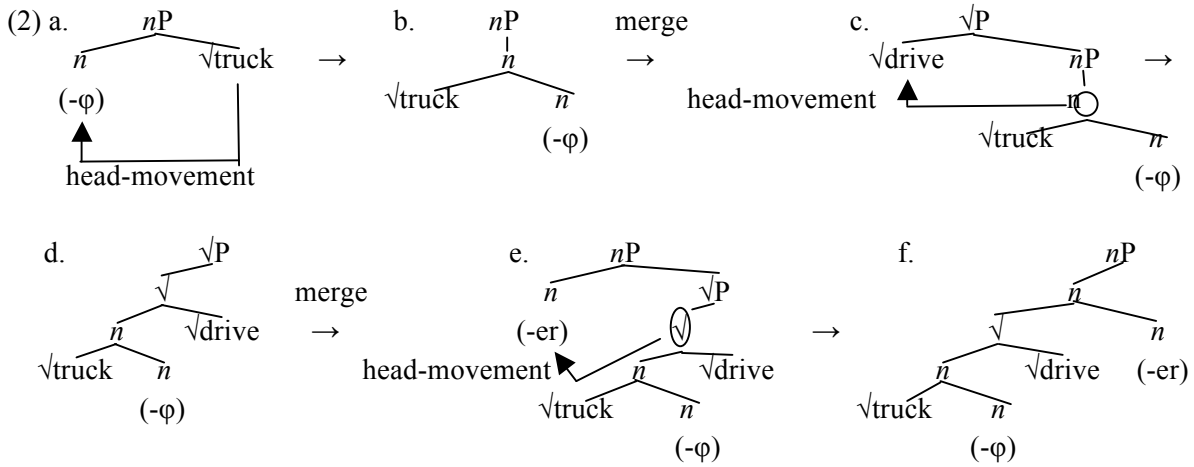
(1)



Two crucial claims are noticeable here. One is post-syntactic morphology: at the PF interface, a series of operations, such as merger and impoverishment, are applied to a syntactic output to construct a word structure. The other is late insertion: lexical items in vocabulary are inserted into the terminal nodes of the word structure. Thus, prolonging morphological operations and lexical insertion beyond Spell-Out pursues universality of syntax.

3. An Analysis of Nominal Compounds: Harley 2009

Harley 2009 proposes that compounds are formed by the syntactic merge of roots and categorizing heads like *n* and *v* together with syntactic head-movement, following the current framework of DM (Embick and Marantz 2008).[1] For example, the derivation of *truck driver* is as follows: in (2a) when the root √*truck* merges with *n* and head-moves to it, (2b) is derived. The *n*P in (2b) then merges with √drive as in (2c) and head-moves to it to yield (2d). Finally, the √P in (2d) merges with *n* (*-er*) as in (2e) and the head √ moves to the *n* (*-er*) to obtain (2f).



[1] Root (√) is defined as bound morpheme that becomes the core of a word.

There are three noteworthy problems for this analysis. First, the mismatch between form and meaning cannot be captured naturally. Let us point out two cases. The first case is plurality within a word-internal element, as exemplified in (3). The plurality is implied but not encoded in the first element of the compounds *rock throwing* in (3a) and *claw removal* in (3b). Note that the corresponding derived nominals have the implicit plurality materialized, as in *the throwing of rocks by youths*. Hence, as illustrated in (4), an imbalance between form and meaning is found in a certain set of compounds.

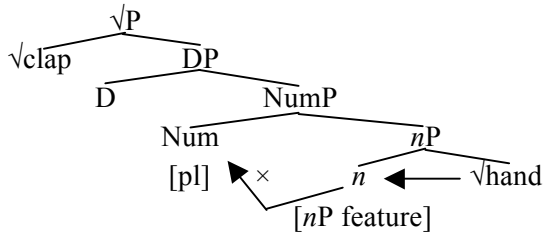
(3) a. Soon gangs of unemployed youths *were throwing* ***rocks*** at stores accused of price gouging. As the ***rock*** *throwing* (i.e. *'the throwing of rocks by youths'* (JM)) gave way to looting … (*Time*, May 7, 1984, p. 25)

b. Without the pinpoint contact of the tips of *the* ***claws***, the animals may find themselves slipping and crashing to the ground. The expression of confusion observed on the faces of such cats as they pick themselves up is in itself sufficient to turn any cat-lover against the idea of ***claw****-removal* (i.e.*'the removal of the claws'* (JM)). (BNC BMG: 673)

(4) **hand** clapping, **hand**shaking, **eye**-closure form: [singular] □ meaning: [plural]

In Harley's mechanism, the grammatical compound *hand clapping* is derived as demonstrated in (2) above, while the compound **hands clapping* is ruled out in a manner illustrated in (5). In (5), √hand can head-move to *n*, but the composite head *n* ([$_n$√hand *n*]) cannot head-move to Num.[2] The point is that some device which rules out words with internal inflections (cf. **truck****s****-driver*, **school****'s*** *boy*) would preclude compound formation from a syntactic structure containing the [pl] feature. Accordingly, it is not explained that plurality is implied but not encoded in the first element of *hand clapping*.[3]

(5) * [$_n$ hand**s** clapping] □ [$_n$ hand clapping]



(Harley 2009: 140-141)

The second case is a word-internal prepositional element; non-correspondence between a morphosyntactic feature and an exponent is observed in cases like *border fighting*, and a similar

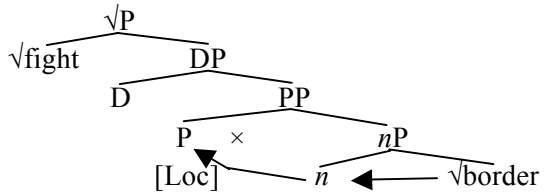
[2] Exactly how the system works is not clear to me, though.

[3] It is noticeable that in Harley's system **trucks-driver* is syntactically ruled out, whereas **to truck-drive* is ruled out by a morphological constraint in English banning v^0 from hosting incorporation (Harley 2009: 141).

argument can be made for it. In each of the examples of (6), a prepositional unit is understood but not materialized in the first constituent. Given the non-occurrence of a functional element within a word-internal segment, the present system will block the composite head *n* ([$_n$√border *n*]) of the inner *n*P from head-moving to P, as illustrated in (7).

(6) *border* fighting (Loc) (*'fighting **on** the border'*), *air* collision (Loc), *night* flying (Time), *knife* fighting (Means), *air* transportation (Means)

(7) * [$_n$ **on**-border fighting] □ [$_n$ border fighting]



Again, it is not explained why Location is implied but not materialized in the first unit of *border-fighting*.

Importantly, the ban against words with internal inflections may be relaxed to a certain degree. The second problem for Harley's analysis is that it fails to account for this fact. Let us first consider the case of plurality within a word-internal element. As shown in (8), we sometimes find a case in which the plural *-s* appears in the constituent of compounds. One might analyze the first element concerned as a frozen unit; for instance, *arts,* in *arts education,* is lexicalized with its specialized meaning (*'humanities'*). However, this does not account for the meaning relationship between (9a) and (9b); *application management* has the compositional meaning 'to manage an application' and 'to manage several applications,' the latter of which is shared by *applications management*. Consequently, Harley's scheme would uniformly rule out compositional compounds such as (9b) as well as (5).

(8) art**s** education, localiti**es** innovation, expectation**s**-slashing

(9) a. application management, truth-evasion, system integration, arm-twisting, tooth-gnashing
b. application**s** management, truth**s** revelation, system**s** integration, arm**s**-twisting, t**ee**th-gnashing

Likewise, a preposition can occur in the first position of compounds, as evident in (10). These cases would also be ruled out automatically by Harley's scheme. Notice that there is no semantic difference between the examples in (11a) and (11b). One cannot say therefore that the

first element of the compound, *in-company training,* is lexicalized with some idiosyncratic special import.[4]

(10) **in**-water decompression, **in**-state loot, **in**-room performance, **on**-field treatment, **off**-the-ice dispute

(11) a. company training, home entertainment, field performance
b. **in**-company training, **in**-home entertainment, **on**-field performance

Finally, Harley's approach fails to maintain two basic DM hypotheses: (i) late insertion—all lexical items are inserted at PF—and (ii) the l-node hypothesis—lexical categories are unspecified during syntactic derivation (Harley and Noyer 2000). Under her view, merge and movement of roots and categorizers generate compounds, which means that (i) roots have phonological underlying forms and hence they are not subject to vocabulary insertion, and (ii) lexical categories are specified in syntax like [$_{n}\sqrt{}$city *n*] and [$_{v/n}\sqrt{}$destroy *v*/*n*]. As a result, the two hypotheses are largely abandoned, thus discarding relevant economical merits.

4. A Proposal

4.1. Compound Formation

A new analysis aims at "well-distributed" word formation: to attribute the core grammatical properties of a nominal to its underlying syntactic structure while consigning the role of its formal make-up to the morphological module. As demonstrated in (12), a derived nominal as well as a nominal compound is often formed on the basis of a preceding comparable VP structure. This suggests that nominals are constructed by simple readjustment of the head word of the corresponding VP, and accordingly a VP and its nominals should be assigned a common core layer.

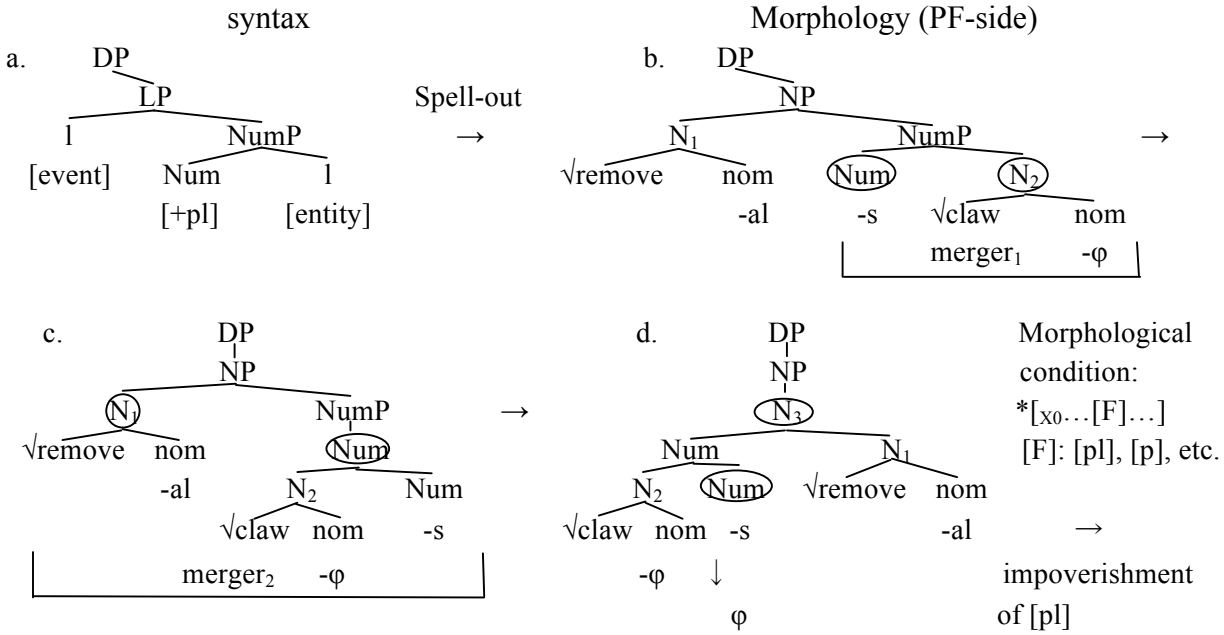
(12) a. … recommended that companies should *include balance sheet information*, that *the inclusion of cash flow information* should be considered … (BNC CBU:4000)
b. The principle of instrument is that of a liquidiser with an impeller that *emulsifies stones*. … the rotary litotrite achieves *stone emulsification* with clearance of stones from gall bladder … (BNC HU3:619)

Based on this observation, the compound *claw removal* is derived in a purely mechanical way, illustrated in (13). Merge constructs syntactic structure (13a), which is sent to morphology, where vocabulary insertion as well as category specification and addition of morphemes are carried out; e.g., according to the general requirement that an l-node be realized as N in the environ-

[4] All the compounds in (8)-(11) are compiled from BNC or contemporary writings.

ment of D-complement (Harley and Noyer 2000: 362), a nominalizer is added to it (cf. Marantz 1996: 25, 29).[5] The linear order is also determined here: in English head comes first in syntax, but head comes last in morphology. The result is structure (13b), to which "merger" is morphologically forced to apply. Merger is defined as the process of combining adjacent constituents (including one that is already derived via merger) in terminal nodes into a zero-level category (Marantz 1996: 24). The N_2-Num merger produces structure (13c), and the subsequent Num-N_1 merger yields structure (13d). Importantly, the derivation is completed with the removal of Num ([+pl]) in accordance with the parameterized morphological condition requiring the absence in the individual elements of X^0 of functional categories. The removal of [pl] is called "impoverishment of [pl]." Impoverishment is defined as "the process of deleting morphosyntactic features irrelevant to morphology, which is the driving force of syncretism" (Noyer 1995: 23-24).

(13) the derivation of *claw removal*



Two points are worth noting here. First, a VP and its nominal are assigned a common core layer in (narrow) syntax (cf. (13a)); the functional category Num with the feature [+pl], [-pl], or [pl] is notably associated with the layer. Num Ps that occur in underlying compound structures is supported by a type of language, which allows plural marking in noun incorporation, as described below. We may say then that the essence of nominalization is to copy the LP within a preceding *v*P in a nominal environment. This claim stands in sharp contrast to Harley's. Second, compound construction is driven by morphological requirements, and hence compounding is naturally carried out in morphology. Affixes have the property of "boundness"; the plural suffix

[5] Nom(inalizer) is defined as noun-forming derivational suffix which may combine with roots.

-s in (13b) has to combine with its host and this requirement brings forth the N_2-Num merger. Further, the Morphological condition ensuring that no phrase consists of a head and a word or a non-maximal phrase sets off merger, as seen in (13c), where the head N_1 and the complement Num are combined into a compound by merger.[6]

4.2. Theoretical Implications

The proposed analysis has three major theoretical implications, which offer a key to solving Harley's problems. The first consequence of our analysis is that the compounds concerning functional categories like Num and P are treated accurately and elegantly; although they are normally removed as irrelevant and so they are not materialized in morphology, the relevant features remain at LF and are correctly interpreted there. In (14a) for instance, the compound *cattle control document classification* has the constituent *cattle control document* with tacit plurality. Crucially, the feature concerned is still present at the level of semantic processing (LF) and so it is properly construed there. Similarly, in *close-quarters examination* of (14b), the idiomatic interpretation of the constituent *close-quarters* is concisely gained when accompanied by the [+p] feature at LF.[7]

(14) a. cattle control **document** classification (BNC KSH:4263)
(cf. classification of cattle control **documents)**
b. **close-quarters** examination (BNC A6X:1375)
(cf. idiom: **at close quarters** *'very near or near together'*)

The second consequence of our analysis is that parametric selection on language-particular varieties is kept in the post-syntactic morphology, thereby making syntactic computation universal. Nouns like *trousers* and *scissors* are not commonly used in singular forms, whereas the singular forms are permitted when they occur in compounds, as demonstrated in (15). This fact supports the morphological constraint in question.

(15) **trouser** pocket, **scissor** making, **Beatle** medley (BNC)

The constraint seems to operate in Japanese and Afrikaans as well. Japanese has two types of pluralization, as illustrated in (16). One way is to add the plural suffix *-tachi* to a base noun, as

[6] The present morphological requirement is arguably a reformulation of one of the basic principles of X-bar theory: only maximal projections may appear as non-head terms within a phrase (cf. Stowell 1981: 66-67). Additionally, the fact that maximal phrases cannot be incorporated into compounds (cf. **[every claw] removal*) will provide supporting evidence for this requirement.

[7] Idiom-incorporating compounds such as *close-quarters examination* and *tooth-gnashing* in (9a) provide clear evidence of the morphological impoverishment of [F].

in *seito-tachi* '*pupils*.' The other way is to reduplicate a root, as in *yama-yama* '*mountains*.' These plural elements cannot occur in ordinary deverbal compounds as seen in (17a), offering confirmation for the relevant constraint. When they occur in postsyntactic compounds, however, the compounds are regarded as awkward, as seen in (17b). Postsyntactic compounds characteristically have a slight pause between their constituents and are argued to have phrasal properties as well as lexical ones (Shibatani and Kageyama 1988). It should be noticed here that the condition concerned might be varied in its degree of applicability depending on compounding patterns.

(16) a. seito-**tachi** *'pupils'* (suffixation)
b. yama *'mountain'* → yama-**yama** *'mountains'* (reduplication)

(17) a. [seito(***tachi**)-shido] *'pupil(*s)-instruction'* [hana(***bana**)-saibai] *'flower(*s)-growing'*
b. [seito(?**tachi**):shido] [hana(?**bana**):saibai] (The symbol ":" signifies a slight pause.)

Similarly in Afrikaans, plural markers and prepositions are generally prohibited in an intra-word position, as evidenced by (18).

(18) * leeu - s - byt -ER (* op - die -) strand - loop -ER
lion -s bite -er on the beach walk -er (Botha 1980: 106-115)

Summarizing our discussion so far, the three languages select the morphological condition at issue as a restriction imposed on word structures, which triggers a morphological impoverishment, deletion of the [F] feature at PF.

On the other hand, we have already seen that words incompatible with the constraint can be formed. Contrast the examples in (15) above and those in (19) below. In (19), the plural forms are permitted although they take place in compounds.

(19) **trousers**-pocket, **scissors**-grinder (Jespersen 1949:187); **Beatles** medley (BNC HGL:1989)

A determining factor of causing this incompatibility is the principle of "avoid ambiguity," as is suggested by Selkirk 1982: 52-53. Consider a set of compounds in (20).[8] To take *application management* as an example, since the first unit *application* usually has no plural marker, the compound can mean either 'to manage an application' or 'to manage several applications.' To remove this ambiguity, the plural marker *-s* is provided for the form corresponding to the latter interpretation. The same argument applies to preposition-containing compounds. In the com-

[8] All the compounds in (20) are extracted from BNC or contemporary writings.

pound *in-water decompression*, ambiguity would be produced if the preposition *in* were not specified; it would mean 'to decompress water' or 'to decompress something in water.'[9]

(20) a. **applications** management, **truths** revelation, captain-to-**passengers** announcement, **Times**-reading
b. **in**-water decompression, **in**-state loot, **off**-the-ice dispute

Comparable Afrikaans examples are given in (21):

(21) tussen - (leier - **s**) - kies -ERY (**in** - die -) klss - praat -ER
between leader -s choose -ing in the classroom talk -er
(Botha 1980: 112, 115)

It is relevant to note that cross-linguistically; languages vary in their flexibility to the constraint under discussion. Afrikaans seems to have greater flexibility to this constraint; Botha 1980: 112-115 provides a set of good examples to show this. Sometimes a preposition is obligatory in Afrikaans compounds, as in **(met) - mekaar - stry - ERS* (with each other argue -ers), and this example also indicates that a reciprocal pronoun may incorporate into compounds. A relevant plural marker may be obligatory as well; the plural *-s* obligatorily arises in the first compound of (21). From these observations, the constraint appears more likely to be relaxed in Afrikaans. Conversely, Japanese seems entirely obedient to the constraint in that a plural marker never occurs in the constituent of standard (non-postsyntactic) deverbal compounds (cf. (17a)).

Interestingly, Farkas and de Swart (2003) claim that languages differ in whether number contrast in incorporated constructions is morphologically marked or not, classifying Hungarian and Hindi as the former type. Examples of noun incorporation in Hungarian are given below:

(22) a. Feri feleséget Keres.
Feri wife.Acc seek
'Feri is looking for a wife.'

b. Mari bélyeget gyüjt.
Mari stamp.Acc collect
'Mari is collecting stamps.'

(23) Mari verseket olvas.
Mari poem.PL.Acc read
'Mari is reading poems.'
(Farkas and de Swart 2003: 12-14)

[9] Since full DPs are strictly blocked from the incorporated positions of compounds, an indefinite article, a marker of singularity, cannot occur in word-internal elements (cf. **[a subject] writer*). To specify singularity, the numeral *one* could be used instead, as in *Nor is Gordimer a one-subject writer* (*Time*, July 23, 1984, p.54). This is another case of avoid ambiguity.

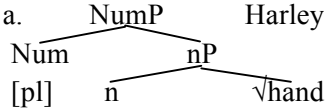
In (22), the incorporated nouns have no inflectional marking of plurality. An incorporated noun without a plural marker indicates a singular interpretation ((22a)) or a plural interpretation ((22b)), and the choice between them depends largely on the predicates and contexts concerned. An incorporated noun is also morphologically marked by the plural suffix *Vk*-, as in (23). The plural marker readily combines with incorporated nouns to specify plurality in the ordinary sense of 'more than one,' but not a generic reading, which cannot be marked by a bare plural (one without a determiner). Thus, Hungarian is a language that does not follow the present constraint or exhibits a very high degree of flexibility to it.

To sum up the second consequence, it is argued that there exists a morphological condition prohibiting the occurrence of [F] in an intra-word constituent. This condition may be overruled to a certain degree by the principle of "avoid ambiguity," which should be specified in terms of the applicability of the morphological condition. Further, the easing of the constraint varies depending on word formation patterns and individual languages, and the variability in constraint relaxation can be parameterized. Consequently, word-internal functional morphemes may be better handled in morphology, which involves a series of language-particular variations.

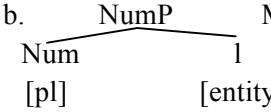
The final consequence of our analysis is that the lexically underspecified syntax based on late insertion and the l-node hypothesis severely limits the available information and operation at each point of computation. To see the first case, compare Harley's analysis and ours, depicted in (24a) and (24b) respectively. In Harley's analysis (24a), functional categories are subject to vocabulary insertion at PF, whereas lexical categories (roots) are present in syntactic derivation. Consequently, major parts of vocabulary items do not follow the late insertion thesis.[10] By contrast, in our analysis (24b), lexical as well as functional categories are subject to vocabulary insertion at PF. As for the l-node hypothesis, in (24a) the root √hand is virtually specified as noun, while in (24b) the lexical category is not specified during syntactic derivation. Thus in our analysis, syntactic computation is deprived of the burden of lexical specifications—the statements of lexical categories and meanings, which leads to a welcome simplification of the syntactic machinery.

(24) **syntax**:

a. Harley



b. Morita



[10] Harley and Blanco 2013 propose that the phonological features of roots are supplied later. Assuming that each root is registered on both $List_1$ and $List_2$, they claim that a root in $List_1$ is provided with syntactic features and hence is introduced in the course of syntactic computation, while the corresponding root in $List_2$ is equipped with phonological exponents and the proper one is selected on the PF side. This, however, implies that each item is doubly listed in separate modules, against the interests of linguistic economy.

The second case of the present constraint relates to late insertion, which has a significant semantic consequence: three kinds of semantic information are properly distributed to each relevant component. Three subcomponents of the grammatical architecture are recognized in a framework of DM: Pure Lexicon, Vocabulary, and Encyclopedia (Harley and Noyer 2000: 351-352). Compositional meanings, which stem from syntactic features, are distributed to Pure Lexicon. Lexical meanings, which are the senses of roots and affixes, are allocated to Vocabulary. And finally idiosyncratic meanings, which are the senses of complex words unpredictable from the senses of internal elements, are stored in Encyclopedia. Only regular and compositional meaning is thus handled in the universal syntactic computation to LF.[11]

Finally, the l-node hypothesis has a train of morphosyntactic consequences: word make-up operations are exclusively implemented in morphology. In Harley's mechanism, which does not admit this hypothesis, the categorizing heads corresponding to affixes exist in syntax, taking part regularly in merge and head-movement to construct compounds. By comparison our analysis claims, on the l-node hypothesis, that lexical categories are specified in morphology on the PF side, which leads the addition of affixes. The "boundness" nature of affixes and the requirement of a maximal projection as non-head term in turn set off word make-up. As a result, nominal compounds are constructed by Morphological merger and impoverishment, not by syntactic merge and head-movement; head-movement for word construction is thus excluded from syntax.

5. Conclusion

On the basis of extensive data, we have argued for the "well-distributed" morphology, which contrasts sharply with Harley's position that assigns excessive powers for word formation to the syntactic component. Specifically, we claim optimum distribution of word formational information at different grammatical levels: three types of semantic information on nominals should be well distributed to each relevant component. Moreover, two kinds of their morphosyntactic information are required to be dispersed to each relevant module; phrase-constructing information is allocated to the syntactic component, while word make-up information such as specification of lexical categories is assigned to the morphological module. The underspecified syntax built on late insertion and the l-node hypothesis lends strong support to the economy principles of the Minimalist Program, which severely limit the available information at each stage of computation (Halle 1994: 3).

[11] The vocabulary insertion systems based on localist theory have been put forward: a word form is processed to obtain a proper phonological form at PF by allomorph selection in local environments (Embick 2010), and a word is readily interpreted on the LF side by phase-based "alloseme" choice for insertion (Marantz 2013).

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