The Unified Representation of Words

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I

Words are the meaningful minimal unit of linguistic expressions; that means they are composed of words (morphemes) since sentences are composed of phrases, and phrases of words. Thus, without words we could not represent structural linguistic expressions. In consequence of that, to show the role played by words in language, this paper aims at exploring the representation of words, considering their structure.

In general, it is said that words can be classified in the following way in terms of the structure of words:

(1) Word
- Simple Word
- Compositive Word
  - Derived Word
  - Compound

Simple words, such as "beauty," "school," and so on, are not affected by such processes as derivation and compounding. Then by adding derivational affixes (prefix and suffix) to simple words, we can get derived

words such as "beautiful," "teacher," and so on, and compounds can be derived through the process of compounding of simple words or derived words. Examples of compounds are the following: "beauty contest," "entrance examination," and so on.

The classification is made clear in the above explanation; however, the definition concerning a word is not clear. According to Jespersen (1924)[1] and Bloomfield (1933),[2] a word can be defined as follows:

(2) a. Word can occur independently.
b. Word is an inseparable unit.
c. Word is a meaningful unit.
d. Word is a minimal unit.

Such a word as fulfills the definitions from (2a) to (2d) is considered to be a word itself. On the other hand, the constitutional element of a word, that is, an affix such as "–er" of "singer" fulfills the definitions from (2b) to (2d), not (2a). That element is classified into the group "morpheme." Strictly speaking, a word is also a part of morpheme, that is, a free morpheme. To make clear a distinction between two morphemes, a morpheme which cannot occur alone is called a bound morpheme.

In this section we have considered the classification and definitions of words, and in what follows we will explore the constraints on both derived words and compounds, considering the problem caused by them, and show a unified explanation concerning word formation.

II

A word is a part of linguistic expressions, just as a sentence is, and as a result, the grammaticality of a word enters into a broad range of consid-

erations. To make the grammatical representation of words, some constraints are necessary. Thus, in this section, we will consider two of them: Righthand Head Rule and Feature Percolation.

Selkirk (1982)[3] treats word formation rules as phrase structure rules; she argues that". . . certain notions of X-bar theory, a theory of S-structure. . . are required for an insightful characterization of W-structure,"[4] and two ideas of X-bar theory enter into the consideration of the structure of words. The two ideas are as follows:

(3) [5]The first is that. . . a syntactic category is a pair. . . consisting of a category *type* or *level* specification *n* (the number of "bars" of the category) and a feature specification. . . . I will call the feature specification the category *name*. . . . Words of the category Noun, Adjective, Verb, etc., will thus have the category symbol N^0, A^0, V^0, respectively. . . . The class of words itself is designated by the symbol X or X^0. . . . Categories of level X^1 and higher are phrases. X^1, for example, is the category level which dominates the head X and its complements. . . .

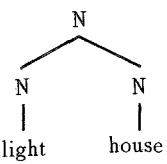
The second basic idea of X-bar theory. . . is that the phrase structures of language conform to certain restrictive patterns, the characterization of which requires the X-bar theory of categories. . . . the hypothesis. . . is that phrase structure rules conform in general to a schema such as (1.5):

(1.5) $X^n \rightarrow \ldots X^{n-1} \ldots$

The second idea of the X-bar theory amounts to the claim that all S-structures have a head; the feature of the heads is that the properties of the head are those of the whole. However, the definition of heads in morpholo-

gy is not the same as that in syntax. In syntax a head of a phrase is the only daughter of the phrase that is not a maximal projection.[6] On the other hand, in morphology, a definition in syntax is not available; in morphology the daughters of a compound are not distinct from one another, as indicated in the following example:

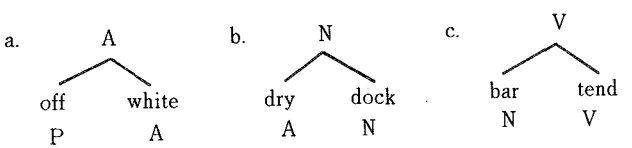
(4)



In (4) we cannot elucidate which N is the head of the whole, because two members of the whole are both of the same category, namely, N. Thus morphology must avail itself of a different means of identifying the head.

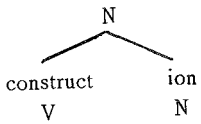
According to Williams (1981),[7] in morphology, unlike syntax, the righthand member of a word determines the category of the word, so that this member comes to be the head; thus this rule is called the Righthand Head Rule. The availability of this rule is made clear in the following examples in which the righthand member of each word determines the category of the word:

(5)[8]



Moreover the head determines the plurality and other general features of the word. Here notice the following example:

(6)[9]



In (6) the suffix "-ion" determines the category, plurality, and so on, of the whole word. Thus Williams (1981) proposes that suffixes themselves belong to the categories N, V, and A.

Indeed the Righthand Head Rule can explain with ease simple compositive words like (5) and (6). However, a problem concerning the feature of the head arises; as mentioned above, the head determines the category, plurality, and other general features of the word. As for other general features of the word, however, this rule is not always available. Notice the following examples in which the non-righthand members of a derived noun and adjective determine the subcategorization of words:

(7) a. his *sure*ness *that* John would win[10]

b. Mary is *depend*ent *on* her parents.

The lefthand members "sure-" and "depend-" determine the selection of complement; thus that amounts to the claim that as for the subcategorization, the righthand member of the word is not considered to be the head. Then notions such as "syntactic head" and "semantic head" should be introduced into our framework. We will explore this problem in what follows.

As mentioned above, the condition that the properties of the head are inherited to the whole word plays a crucial role in the representation of words. Selkirk (1982) formulates this condition as follows:

(8) Percolation

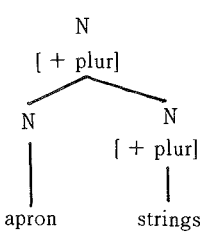
If a constituent α is the head of a constituent β , α and β are associated with an identical set of features.[11]

For derived words and compounds to be grammatical, the above-mentioned condition must be satisfied. This condition leads us to the conclusion that:

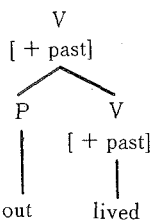
(9) In syntactic structure. . . a VP and its head verb bear the same features for tense. . . or . . . the case features accorded an NP are identical with those borne by its head noun. In morphological structure. . . a constituent type Word. . . has the same features as its head.[12]

Thus the ideas concerning the representation of words, namely, Righthand Head Rule and Percolation can justify the following examples:

(10)[13] a.



b.



Ⅲ

As indicated in section II, it is not the case that at any time the righthand member of the whole word is the head; thus the notion "head" should be relativized. Di Sciullo and Williams (1987)[14] defines the notion "relativized head" as follows:

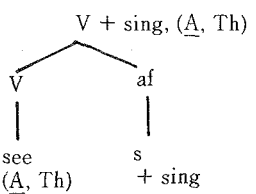
(11) Definition of "head $_F$" (read: head with respect to the feature F):
The head $_F$ of a word is the rightmost element of the word marked for the feature F.[15]

The relativized head is peculiar to morphology; thus the difference between the head in morphology and that in syntax is whether it is contextual or not:

(12) In syntax the head is identifiable by an intrinsic feature (it is a non-maximal projection), not contextually; so there can be no relativization of the head in syntax because there is only one potential head in the first place. The relativization of the head in morphology thus exploits the contextual definition of head in morphology.[16]

Applying the notion "relativized head" to the definition of head in morphology, words can have two heads; they have a head $_{F_1}$ and a head $_{F_2}$, where F_1 and F_2 are different features. In (13) we can assume in general that "inflectional affixes are not marked with argument structures, so the head $_{\text{argument structure}}$ will be the verb stem and not the inflectional affix, while the inflectional affix will still be the head $_{\text{inflectional feature}}$."[17]

(13)[18]



In (13) the V node has two heads, so that the feature of the argument structure percolates up from the verb stem "see" to the V node and that of

the inflectional affix does from the inflectional affix to the V node.

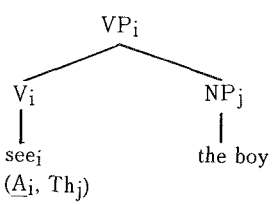
In this section, to solve the problem caused by the theory of fixed heads, the notion of head in morphology is relativized; in consequence of that, this revised notion "relativized head" solves the problem including argument structures and inflections.

Ⅳ

Proposing the new notion concerning head, namely, the relativized head, we can give a unified explanation on the representation of words. Moreover, in this section, the problems unexplored in the above sections will enter into a broad range of considerations.

One of these problems is that concerning argument structures.[19] In an argument structure an external argument is a head. Thus "The external argument index is passed up the X-bar projection. . . because it is the head of the argument structure until it becomes a feature of the maximal projection of the predicate. It is then assigned to the subject of the predicate by the rule of predication, a species of Theta-role assignment."[20]

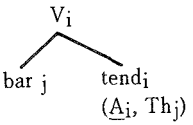
(14)[21]



In (14) the Agent argument is the external argument; the index of the external argument percolates up to the VP node, and then by Theta-role assignment the Agent role is assigned to the subject of the predicate.

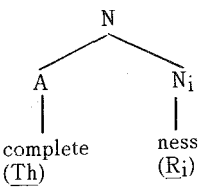
In the compound the argument structure is as follows:[22]

(15)[23]



In (15) the head determines the argument structure of the whole, and relates to the nonhead by Theta-role assignment. On the other hand, the argument structure of the derived word can be considered as follows:

(16)[24]



In (16), as in the case of the compound, the head of the word determines the external argument of the whole; the head "-ness" assigns an external argument to the word, and "the external argument of *completeness* is the argument R that shows up in the paraphrase of the meaning of the word: the degree R to which such and such is 'complete.'"[25] As shown above, the head of the words derived by affixation relates to its nonhead by function composition, which is the notion proposed in Moortgat (1984).[26]

Consider next another problem: "When an affixal head combines with a nonhead stem, the arguments of the nonhead stem, including the external argument, become part of the argument structure of the whole word."[27] In Di Sciullo and Williams (1987), as the means of relating the argument structure of a nonhead stem to a head, a new element, namely, an element abbreviated "f" (for "functor") is introduced into argument structure. A new element "functor" indicates that "the item bearing that element in its argu-

ment structure is a 'functor' with respect to a nonhead complement; we will then link this element with the nonhead complement with superscripts instead of subscripts."[28] Thus we can change the representation of the argument structure of "completeness" (16) into (17):

(17) [29]complete^{i} ness
(Th) (R, f^{i})

To avoid the introducing of a new notation, we can "take the suffix to be a functor by virtue of its semantic type rather than virtue of some element in its argument structure."[30] Then the argument structure is as follows:

(18) [31] complete ness → completeness
(Th) (R) ((Th)R)
functor

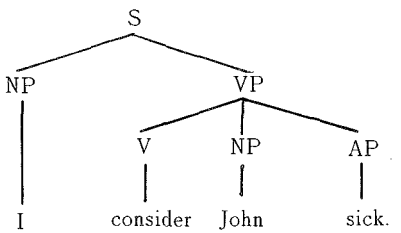
As a result of the above considerations, it is assumed that in the argument structure of derived words, if a head is a functor, then the argument structure of the word is that of the nonhead, and that if not, the argument structure is that of the head.

As shown above, the new notion introduced into our famework in this section, namely, "functor" can give a unified representation on the argument structure of derived words. Then applying this notion to the phenomena not only in morphology but in syntax, we can get a proper explanation for them in syntax. One of them is that concerning small clause constructions, as indicated in Di Sciullo and Williams (1987). Notice the problem concerning small clause constructions before applying the "functor" approach to them.

There have been two approaches to small clause constructions: Wil-

liams (1980)[32] and Safir (1983).[33] In Williams (1980) it is argued that the small clause appears in the following configuration:

(19)



In (19) the NP *John* and the AP *sick* that modifies it in the surface structure are assigned the same index under the rule of predication outlined in Williams (1980). Thus, according to Williams (1980), the underlined string in (20) cannot be considered to be a constituent:

(20) I consider John sick.

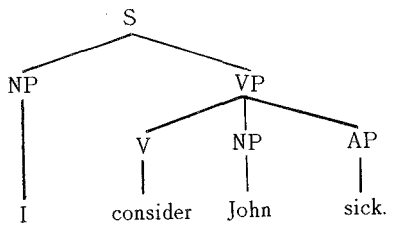
On the contrary, Safir (1983) treats the underlined string in (20) as a constituent. He cites the following sentence as the evidence for treating the string *John sick* as a constituent:

(21) Workers angry about the pay is just the sort of situation that the ad campaign was designed to avoid.[34]

In (21) the problem concerning the agreement is significant since the agreement is singular, even though the NP *workers* is plural. That amounts to the claim that the phrase *workers angry about the pay* must be interpreted as a situation. Thus it follows from the Projection Principle[35] that "every clausally interpreted construction in LF must be a constituent in syntax."[36]

Then let us consider the application of the "functor" approach to small clause constructions. In (22) the head of the VP, namely, the verb *consider* combines with the AP *sick* to compose a complex direct object-taking form *consider-sick* since the head *consider* plays the role of the "functor." This is the claim of the "functor" approach to small clause constructions.

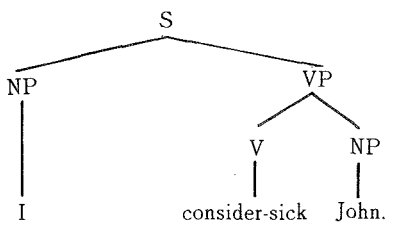
(22)



(functor)

As in the case of *completeness*, the verb *consider* incorporates the argument structure of the AP *sick* into that of *consider*, composing a complex form *consider-sick*. Thus that leads us to the claim that the AP *sick* has the single external argument that cannot become the external argument of *consider-sick* on account of the feature of the head that the external argument of the head of the construction becomes the head of the whole. Then a complex form *consider-sick* takes the argument structure like (A, (Th)), assigning an accusative case to the NP *John*. Thus the sentence (20) has the following configuration:

(23)



(A, (Th))

Indeed we can get a proper explanation for the problem concerning Theta-role and case assignments in small clause constructions. According to this solution, however, the small clause cannot be considered to be a constituent in spite of the fact that (21), repeated here, shows the inevitability of treating the small clause construction as a constituent, since in (23) the AP *sick* combines with the verb *consider*, not with the NP *John*, to compose a complex form.

(21) Workers angry about the pay is just the sort of situation that the ad campaign was designed to avoid.

Then, for a comparison, let us consider small clause constructions in Japanese:

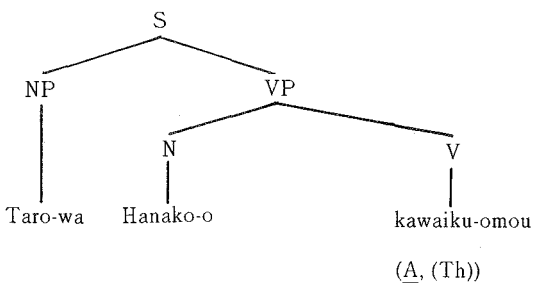
(24) a. Taro-wa [Hanako-ga kawaiito] omotteiru
Taro considers that Hanako is pretty.
b. Taro-wa [Hanako-o kawaiito] omotteiru
Taro considers Hanako to be pretty.
c. Taro-wa [Hanako-o kawaiku] omotteiru
Taro considers Hanako pretty.

In (24a) the NP *Hanako* is assigned the case *ga* by the tense in the embed-

ded clause since it appears in the tense clause; in the ECM construction like (24b) *Hanako* is assigned the case *o* by the main verb *omou*. A small clause in Japanese has the structure like (24c).

Consider next the application of the "functor" approach to small clause constructions in Japanese. It is assumed that as in the case of English, the verb *omou* can function as "functor," composing a complex direct object-taking form *kawaiku-omou*. Moreover this form takes the same argument structure as English: (A, (Th)). Then the small clause construction (24c) has the following configuration:

(25)



If the small clause appears in the above-mentioned configuration, it cannot be taken as a constituent. However, a problem arises that a small clause must be considered to be a constituent in Japanese. Notice the following example:

(26) Taro-wa Akiko-o kawaiku Fuyuko-o tayorinaku omotteiru
Taro considers Akiko pretty and Fuyuko unreliable.

In (26) we must consider *Akiko-o kawaiku Fuyuko-o tayorinaku* to be nothing but a constituent since clauses *Akiko-o kawaiku* and *Fuyuko-o tayorinaku* are combined, composing a coordinate clause licensed by the main verb *omot-*

teiru. Thus we must assume that the small clause construction in Japanese is a constituent, too.

For the "functor" approach to be available, the small clause cannot be a constituent. However, it follows from the Projection Principle and the coordinate clause construction that the small clause must be a constituent. Thus we cannot apply the "functor" approach to small clause constructions in such a way as indicated in Di Sciullo and Williams (1987).

V

This paper aims at exploring the representation of words, considering their structure. Thus, in section Ⅱ, two constraints on words, namely, Righthand Head Rule and Feature Percolation enter into a broad range of considerations of this paper, and moreover the defect concerning Righthand Head Rule is pointed out. In section Ⅲ, in order to solve the problem explored in section Ⅱ, the new notion "relativized head" is proposed; that leads us to the claim that the head in morphology is determined contextually. Morever, in section Ⅳ, together with the notion "relativized head," the argument structure of words enters into a consideration. The difference between compounds and derived words is the means by which the head relates to the nonhead; in compounds the head relates to the nonhead by θ-role assignment; on the other hand, in derived words, the head relates by function composition. Then for the representation of the argument structure of derived words, the new notion "functor" is intoduced into our framework. In addition to that, this notion is applied to small clause constructions. However, this notion is not always available in syntax, as indicated in section Ⅳ. Rather than apply this notion to the phenomena in syntax, we should restrict it to morphology only.

Notes

1. Otto Jespersen, *The Philosophy of Grammar* (London: George Allen and Unwin, 1924), pp. 92–5.
2. Leonard Bloomfield, *Language* (London: George Allen and Unwin, 1933), pp. 179–81.
3. Elisabeth Selkirk, *The Syntax of Words* (Cambridge, Mass.: MIT Press, 1982).
4. *Ibid.*, p. 6.
5. *Ibid.*, p. 6.
6. For the basic ideas and the technical terms of the head in syntax, refer to Noam Chomsky, *Barriers* (Cambridge, Mass.: MIT Press, 1986).
7. Edwin Williams, "On the Notions 'Lexically Related' and 'Head of a Word'," *Linguistic Inquiry* 12 (1981), pp. 245–74.
8. *Ibid.*, p. 249.
9. *Ibid.*, p. 249.
10. T. Roeper, "On the Deductive Model and the Acquisition of Productive Morphology," *The Logical Problem of Language*, eds. C. L. Baker and J. J. McCarthy (Cambridge, Mass.: MIT Press, 1981).
11. Elisabeth Selkirk, *The Syntax of Words*, p. 21.
12. *Ibid.*, p. 21.
13. *Ibid.*, p. 22.
14. A. M. Di Sciullo and Edwin Williams, *On the Definition of Word* (Cambridge, Mass.: MIT Press, 1987), p. 26.
15. *Ibid.*, p. 26.
16. *Ibid.*, p. 26.
17. *Ibid.*, p. 28.
18. *Ibid.*, p. 28.
19. The argument structure of a lexical item is an unordered list of its arguments. Thus the argument structure of the verb "hit" is as follows, as indicated in E. Williams, "Argument Structure and Morphology," *The Linguistic Review* 1 (1981), pp. 81–114.

    hit:(Actor, Theme)

    The notation of underlining is adopted to mark the external argument, and the argument without the notation of underlining is the internal argument. The ex-

ternal argument correponds to subject in some respects, but strictly speaking that is not a syntactic position. This amounts to the claim that in a sentence with "hit," the theme must be specified within the verb phrase of which "hit" is the head, and the Actor of "hit" must be specified in a position external to the verb phrase of which "hit" is the head, but with which that verb phrase is coindexed.

20. A. M. Di Sciullo and Edwin Williams, *On the Definition of Word*, p. 29.
21. *Ibid.*, p. 29.
22. According to Di Sciullo and Williams (1987), the facts concerning the argument structure of compounds are as follows:
    a. A nonhead may but need not satisfy one of the arguments of the head.
    b. It cannot satisfy the external argument.
    c. The arguments of the nonhead are not part of the argument structure of the compound.
    d. Only the external argument of the head is part of the argument structure of the compound.
23. A. M. Di Sciullo and Edwin Williams, *On the Definition of Word*, p. 31.
24. *Ibid.*, p. 32.
25. *Ibid.*, p. 32.
26. M. Moortgat, "A Fregean Restriction on Metarules," *Proceedings of the Fourteenth Annual Meeting of NELS.*
27. A. M. Di Sciullo and Edwin Williams, *On the Definition of Word*, p. 35.
28. *Ibid.*, p. 35.
29. *Ibid.*, p. 35.
30. *Ibid.*, p. 36.
31. *Ibid.*, p. 36.
32. Edwin Williams, "Predication," *Linguistic Inquiry* 11 (1980), pp. 203–38.
33. Ken Safir, "On Small Clauses as Constituents," *Linguistic Inquiry* 14 (1983), pp. 730–35.
34. *Ibid.*, p. 732.
35. In N. Chomsky, *Lectures on Government and Binding* (Dordrecht: Foris, 1981), p. 29, Projection Principle is defined as follows:
    Representations at each syntactic level (i. e., LF, and D- and S-structure) are projected from the lexicon, in that they observe the subcategorization properties of lexical items.

36. Ken Safir, "On Small Clauses as Constituents," p. 731.