

A FUNCTOR—ARGUMENT APPROACH TO JAPANESE NOUN PHRASES

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This paper has a twofold objective. First, we shall present some Japanese sentences which are ambiguous due to the unique behavior of some particular morphemes and explicate it in terms of structure. Second, we shall present a mathematical model using the notion of functor and argument, that is, the former determines the latter to produce a new value, in order to describe the structure.

In Japanese, a noun phrase¹ modifying a predicate nucleus has usually been considered as having a case marker. For instance, in sentence 1:

1. watakusiwa saūgatuni hawaikara nyuuyookuni
 'I 'in March' 'from Hawaii' 'to N.Y.'
 hikookide kita
 'by plane' 'came'

'I came to New York from
Hawaii by air in March.'

-wa in *watakusiwa*, *-ni* in *saūgatuni*, *-kara* in *hawaikara*, *-ni* in *nyuuyookuni* and *-de* in *hikookide* are case markers showing topic, time, starting location, destination and instrument, respectively.

There is a phenomenon in Japanese in which noun phrases of this kind may be omitted freely in a discourse. As a result, we have such sentences as 2 through 6.

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|---------------------|-------------------------|
| 2. watakusiwa kita | 'I came.' |
| 3. saūgatuni kita | 'One came in March.' |
| 4. hawaikara kita | 'One came from Hawaii.' |
| 5. nyuuyookuni kita | 'One came to New York.' |
| 6. hikookide kita | 'One came by air.' |

Similarly, we have:

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|------------------------|-------------------------|
| 7. watakusikara tabeta | 'I was the first to eat |
| 'ate' | (something).' |
| 8. nikukara tabeta | 'One ate meat first.' |
| 'meat' | |

If we consider *-kara* in sentences 7 and 8 to be a case marker, we cannot explain the ambiguity of sentence 9 grammatically.

¹Phrase is defined here as a primary constituent of the clause, which is the minimal independent utterance.

9. ano doobutukara tabeta
'that' 'animal'

- a. 'That animal was the first to eat something (or someone).'
- b. 'Something (or someone) ate that animal first.'

In the case of 9a, *ano doobutu* should be the subject of *tabeta*, and *-kara* implies that there should be additional logical or semantic subjects. That is, there were several animals, but that animal was the one to start eating something or someone. In the case of 9b, *ano doobutu* should be the object of *tabeta*, and *-kara* implies that there should be additional logical or semantic objects. That is, there were several things to eat, but the first thing someone ate was that animal.

Similarly, sentences 10 and 11 have two interpretations. We encounter many exam-

10. sono sarakara tabeta
'that' 'plate'

- a. '(Someone or something) ate (something) from that plate.'
- b. '(Someone or something) ate (the contents) of that plate first (and then something else).'

11. rosuaüzerusukara kita
'Los Angeles'

- a. '(Someone or something) came from Los Angeles.'
- b. '(Someone or something) came to Los Angeles first (and then continued on), or came to somewhere through Los Angeles.'

ples of this kind. The *-kara* in the case of 10a and 11a is the same as that in the sentence 4. It simply indicates the original location. However, the other *-kara*'s are quite different from it. Not only do they indicate that the preceding noun phrase is the first person or thing to do or to be done, or the first place where someone does something or goes to, but also the implication is that there are more persons, things or places involved but not mentioned.

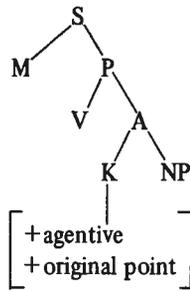
When we compare the pairs in 12 through 15:

12. a. watakusiga iku
'will go' 'I will go.'
- b. watakusikara iku 'I will be the first to go.'
13. a. tegamio kaku
'letter' 'will write' 'One will write a letter.'
- b. tegamikara kaku 'One will write a letter first and then do something else.'
14. a. karenia au
'him' 'meet' 'One will meet him.'
- b. karekara au 'One will meet him first then someone else.'

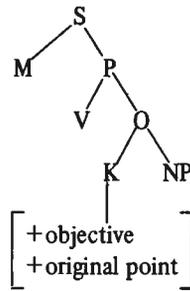
stylistic inversions do not affect Case”.² As we have seen, in Japanese, several grammatical cases can appear at the same place in the sentence. As for the treatment of *kara*, if we use the Chomsky’s model, we think that the only way we can take is to introduce it as the selection of a lexical item.

The most appropriate model of the transformation-generative grammar that can explicate the case system is Fillmore’s case grammar. In case grammar, the system of case, which is assigned in the deep structure, shows the relationship of one or more noun phrases to the verb in the sentence. The mechanisms from the deep structure, which includes a number of NP’s holding special labeled relations (cases) to the sentence, to the surface structure involve selection of overt case forms. This mechanism is, however, rather automatic. And, to explain the ambiguity of the Japanese sentences resulting from such morphemes as *kara*, we add a kind of selection rule, which is illustrated as follows:

17. a.



b.



where

- S sentence
- M modality
- P proposition
- V verb

- A agentive case
- O objective case
- K Kasus
- NP noun phrase

By this rule, however, we cannot show the relationship between the ‘surface’ case markers *ga* and *o*, on one hand, and morpheme *kara*, on the other.

Here, we would like to present an alternative approach, namely, an application of the notion of the “functor” and “argument” with that of constraint and freedom. Curry defines³ “functor” as phrases⁴ which combine phrases to form other phrases. He says:

Every functor combines one or more phrases, called its *arguments*, to form a new phrase called its *value*.⁵

A Japanese case marker could be considered as a functor determining a noun phrase as an argument to produce a new value, which is one of the syntactic units. We could also consider that the *-kara* presently discussed and similar items are a functor which determines an argument produced by an operation of a case marker as a functor onto a noun phrase as an argument.

Consequently, *ano doobutukara* in sentence 9 is considered as being a new value

²Chomsky (1965: pp. 221–222).

³Curry (1961: p. 61).

⁴Curry defines a phrase as a unit in the rules for determining what constitutes a sentence. (*Ibid.*)

⁵*Ibid.*

produced by the operation of the functor *kara* determining *ano doobutuga* (nominative case) for 9a, or *ano doobutuo* (accusative case) for 9b.

We can also consider that 12b, 13b, 14b and 15b are new values produced by an operation of the functor *kara* determining 12a, 13a, 14a and 15a, respectively. The same thing may be said for *made*, *wa*, *mo* and such items.

However, we should not ignore an important phenomenon of language structure, namely, constraint and free choice. For instance, in example 12, we can say all of 12a, 12b, 12c, 12d and 12e, and by choosing one over the other we specify one of many different meanings for communication. But we cannot say, for example:

- | | | |
|--------|-----------------|--------------|
| 12. f. | *watakusini iku | (dative) |
| | *watakuside iku | (ablative) |
| | *watakusio iku | (accusative) |

That is to say, constraint refers to the limitation of particular forms which fit in certain environments. Free choice, on the other hand, refers to the variety of forms that can be utilized for communication. To clarify the situation, we may add additional examples. In

18. John ate a pineapple.
19. He saw John eat a pineapple.

we have to use particular forms of *eat* for each case. We cannot say

20. *John eat a pineapple.
*He saw John ate a pineapple.

but within the above mentioned constraint, we have the freedom to choose one form over another to convey a difference in meaning. Consequently, we can say, for instance:

22. John is eating a pineapple.
23. He saw John eating a pineapple.

When we consider Japanese noun phrases from this point of view, we can easily find that case belongs to the category of constraint. The reason why we cannot say 12f, 12g and 12h is that they have a wrong case marker for this particular noun phrase in relation to the verb. In other words, the occurrence of case markers is determined by each verb phrase. Moreover, within this restriction of the case, we have the freedom to choose, say, *watakusiga* over *watakusikara* in case of 12, or *tegamikara* over *tegamio* in case of 13.

In relation to these categories of constraint and freedom, we apply the notion of functor and argument to the structure of Japanese noun phrases.

We shall restrict the meaning of argument and functor and use the term argument to describe a variable which has a syntactic variable as its indeterminate value. Accordingly, its range of values must be determined for it to function as a syntactic variable. The syntactic variable forms part of the range of an argument of categories of freedom which alternate in the range. The special operator which determines the range of a variable is a functor. Thus a functor forms a syntactic variable out of an argument.

By applying the above-mentioned notion of argument and functor, we can grammatically explain the ambiguity of sentence 9. That is, *ano doobutukara* in 9a has the

same category of constraint as *ano doobutuga*, while *ano doobutukara* in 9b has the same category of constraint as *ano doobutuo*, but both of the sentences have the same category of freedom. It is illustrated in the diagram below:

sentence	form	category of constraint	category of freedom
9a	<i>ano doobutukara</i>	nominative	<i>kara</i>
9b	<i>ano doobutukara</i>	accusative	<i>kara</i>
	<i>ano doobutuga</i>	nominative	(unmarked)
	<i>ano doobutuo</i>	accusative	(unmarked)

Finally, we shall discuss a way of presenting this operation as rules. Functors of category of constraints and freedom are given to the right and left, respectively, of the slant line (/), which is followed by an argument, e.g.

24. *kara* / nom(NN)

where the functor of category of constraint is nominative (nom), while that of freedom is *kara*. The *NN* represents an argument.

In order to cite the argument from a syntactic variable, we use the lambda operator (λ), which was introduced by Church, who says:

If *M* is any formula containing the variable *x*, then $\lambda x[M]$ is a symbol for the function whose value are those given by the formula.⁶

Using this notation, we can present the argument of a particular word form. For instance, that of noun form *daigakuga*, 'university (nominative)', can be presented as:

25. $\lambda \text{nom}(\text{daigakuga})$

where the slant is omitted because the category of freedom is unmarked in this case.

Furthermore, from the above formula, we can present each word form of this noun, e.g.

26. *kara*/nom $\lambda \text{nom}(\text{daigakuga}) = \text{daigakukara}$
 27. *made*/nom $\lambda \text{nom}(\text{daigakuga}) = \text{daigakumade}$
 28. *acu* $\lambda \text{nom}(\text{daigakuga}) = \text{daigakuo}$
 29. *kara*/*acu* $\lambda \text{nom}(\text{daigakuga}) = \text{daigakukara}$

For convenience, we can use α to stand for *nom* as standard citation form. Then, 26, 27, 28 and 29 can be rewritten as the following, respectively:

- 26'. *kara*/nom $\lambda \alpha (\text{daigakuga}) = \text{daigakukara}$
 27'. *made*/nom $\lambda \alpha (\text{daigakuga}) = \text{daigakumade}$
 28'. *acu* $\lambda \alpha (\text{daigakuga}) = \text{daigakuo}$
 29'. *kara*/*acu* $\lambda \alpha (\text{daigakuga}) = \text{daigakukara}$

⁶Church (1932: p. 352).

Then we can present the structure of sentences 9a and 9b in general terms as follows, respectively:

30. a. $[kara/nom \lambda\alpha(NN)] \longrightarrow V$
 b. $[kara/acu \lambda\alpha(NN)] \longrightarrow V$

Now we can see some advantage of this approach over others. First, the categories of constraint (cases here) and of free choice are explicitly presented. And the relationship between the former and latter is shown clearly in terms of functor and argument. Second, our approach presents the base form of a particular noun in the form of argument. And finally, once we present a parameter of all possible forms of a certain word in terms of 1) the category of constraint and 2) the category of free choice, any syntactic variable can be picked up from the parameter automatically by means of the above formulae.

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