CONTROL OF GAPS AND REFLEXIVES IN JAPANESE

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1. Introduction

In natural languages, it is often the case that some element of a sentence is semantically related to another element in the sentence. In Japanese, such a phenomenon typically appears in reflexivization. We have an NP zibun, which literally means only 'self,' that is usually related to the subject of the sentence. In this case, the semantic relationship is that of coreference. Another kind of semantic relationship appears in causativization and passivization. The embedded VPs in these constructions are related to the object of the matrix sentence; the object is semantically the subject of the embedded VP.

I will call the phenomena typically exhibited in these constructions control phenomena. In short, the reflexive zibun is controlled by the subject, and the embedded VP in causatives and passives, or the "missing subject" of the VP for that matter, is controlled by the object of the main clause.[1]

Control phenomena in English, or any other natural language, have been one of the most actively studied phenomena in generative grammar. The studies within the transformational framework have involved such rules as deletion, raising, or their interpretive rules for the unspecified null pronoun. There have also been non-

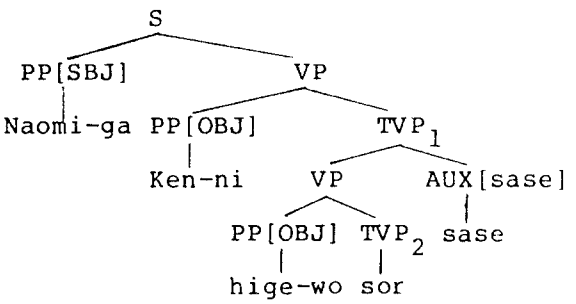
and/or pre-transformational descriptions of control. One of the comprehensive summaries of the tranditional observations is given by Bach (1979) and have been know as "Bach's principle" (Dowty 1982). Bach's principle can be stated in terms of the relationship between grammatical relations and the function-argument structure of the constituents (e.g., in the logical tranlation in Montague sematics). Since the subject is the argument of the VP, and the object is the argument of the TVP, we have the following restatement, due to Dowty (1982).

(1) If a controllee is in an XP (X=V or TV), it is controlled by the argument of the XP, i.e., next higher NP outside the XP.

The case for reflexivization in Japanese follows the generalization stated above with X=V, while causatives and passives follow the above statement with X=TV. For example, (2a) below has the phrase structure shown as (2b).

(2) a. Naomi-wa Ken-ni hige-wo sor-ase-ta.
TOP mustache shave CAUS PAST
'Naomi made Ken shave his mustache.'

b.



TVP_1 contains an embedded VP hige-wo sor, whose "semantic subject" is identified with the object Ken.

Another kind of control which follows Bach's principle is that of gaps (so-called "zero pronouns"). Japanese allows one of the constituents of a sentence to be absent from the utterance:

(3) a. Ken-wa Naomi-ni moo soto-wo arukenai-to itta.
TOP any_longer outside cannot_walk COMP said
'Ken told Naomi that (he) could no longer walk outside.'

b. Naomi-wa Ken-ni demo aisiteiru-to itta.
TOP novertheless love COMP said
'Naomi told Ken that she nevertheless loved him.'

In (3a), even though the subject of the embedded sentence is missing, it can be identified with the subject of the matrix sentence, namely, Ken. (The parentheses in the English translation indicate that there is no counterpart in the original Japanese sentence.) The gap can also be an object as in (3b). In these cases, the subject gap of the embedded sentence is controlled by the subject of the matrix sentence as in (3a), and, moreover, the object gap of the embedded sentence is controlled by the object of the matrix sentence as in (3b).

So far, we have seen the following control phenomena: (i) object control of embedded VPs in causatives and passives; (ii) subject control of reflexives; (iii) subject control of subject gaps; and (iv) object control of object gaps. In this paper, I will propose a nontransformational analysis of control phenomena based on the framework of generalized phrase structure grammar (GPSG) initiated by Gazdar (1981, 1982) et al, which is a context-free phrase structure grammar equipped with a systematic model-theoretic semantics in the style of Richard Montague. The GPSG

framework is based on the hypothesis that transformational rules are not only unnecessary in generative grammar, but are quite often harmful. All we need in grammar is a set of rich, systematic metagrammatical devices to increase the expressive power, while keeping the generative power, of phrase structure grammar. This paper is one of the attempts to show that such a general move in generative grammar is well-motivated, based on the facts from a particular language, Japanese. Phenomena of control, which have often been cited as evidence of the need for transformations in Japanese, thus no longer provide such evidence. Since this paper does not include a detailed introduction to GPSG, the interested readers are referred to the literature cited above, as well as Gazdar and Pullum (1982) and Gazdar, Klein, Pullum, and Sag (1982) for more recent technical developments of GPSG.

In the current analysis, apparently diverse phenomena of control are classified into two cases: obligatory and optional ones. The former corresponds to (i) above and comes from the organization of some particular phrase structure rules. The latter, which covers the remaining three cases, is due to the existence of the parallelism among the phrase structure rules, which can be captured by a metagrammatical device available in GPSG.

In the next section, I will present a brief summary of how obligatory object control in causatives and passives is treated in GPSG. After some preliminary discussions of gaps in Section 3, the metarule will be presented in the following section and we will see how gaps and reflexives interact with control.

2. Control Phenomena

2.1. Obligatory Object Control

Let us consider the case of causativization closely. One of the notable facts about causativization and similar constructions is that the object control is obligatory. In the case of reflexivization (cf. Gunji (1983)) and control of gaps (cf. below), the control is optional in the sense that the potential controller (e.g., subject) doesn't have to control. Other potential controllers, either the ones in the higher sentences or a pragmatic one, are legitimate candidates as well. Thus, (4a) is ambiguous, while (4b) is not.

(4) a. Ken-wa Naomi-ga zibun-wo nikundeiru-to omotteiru.
TOP self hate COMP think
'Ken thinks that Naomi hates herself/him/Z.'

b. Ken-wa Naomi-ni Tomio-ga Marie-ni keeki-wo
TOP cake
tukur-ase-ta-to itta.
make CAUS PAST COMP said
'Ken told Naomi that Tomio made Marie bake cake.'

This contrast motivates different treatments of respective contstructions. Optional controls will be described by essentially having duplicate phrase structure rules in the grammar, which will be disscussed in later sections. Obligatory control is treated

simply as the property of particular morphemes such as sase in causativization and rare in passivization. Thus, the particular phrase sturcture rules involving these morphemes are responsible for obligatory control.

The syntactic and semantic rules for causativization I am assuming is as follows (cf. Gunji (1983)).

(5) a. <10, $[_{TVP}$ VP AUX[sase]], AUX'(^VP')>
b. <11, $[_{AUX[sase]}$ sase], sase'>
c. sase' = $\lambda X \lambda Q \lambda P P\{\hat{x}CAUSE(x, X\{Q\})\}$

These rules altogether give the following translation for a TVP consisting of a VP and sase.

(6) $\lambda Q \lambda P P\{\hat{x}CAUSE(x, VP'(Q))\}$

It is exactly this form that formally expresses Bach's principle. The key is that in the semantics, CAUSE has a proposition as the second argument and hence the VP' has its argument position filled in order to plug in CAUSE. In such a case, Bach's principle predicts that the next higher NP (PP) will be used to fill in. That is, the "missing subject" of the embedded VP is supplied by the semantics as the variable Q, which is bound by a lambda at the outermost level. The lambda-binding ensures that "the next higher NP (PP)" will be supplied to control the "missing subject."

Note that the translation such as (6) is incorporated as part of the lexical information of a particular lexical item, i.e., sase; (5b) and (5c) are lexical syntactic and semantic rules, respectively. This is, however, by no means the only possible way

to describe the obligatory control phenomenon. Since the passive suffix rare has the same kind of translation (cf. Gunji (1983)), these particular translations are in fact predicted from the semantic types of the suffixes; in these cases, they are both predicates which take a VP to form a TVP. (See Jacobson (1982) and Sag and Klein (1982) for attempts to give systematic translations to such predicates in GPSG.)

Tranditional transformational analyses have postulated an embedded sentence for the deep (or even the surface or S-) structures of causatives and passives to explain the control phenomena. For example, (2a), has a deep structure like (7):

(7) Naomi Ken [$_S$ Ken hige sor] sase

Note that the controller (i.e., the object) of the surface embedded VP hige-wo sor is explicitly duplicated as the subject of the embedded S in the deep structure. Since the standard Aspect-type theory of transformational grammar assumed that the deep strucutre was the input to semantic interpretation, and since usually only sentence embedding was assumed, a sturcutre like (7) was the only conceivable structure for causatives.[2]

More recent transformational analyses (particularly interpretive ones, e.g. Inoue (1978)), which are based on the recognition that the power of transformations has been too powerful, postulates a dummy in the subject position of the embedded sentence and let the "semantic interpretation rules" take care of determining the correct antecedent of the dummy. These are, however, still incomplete moves, because sentences, not VPs,

are assumed to be embedded (cf. note 2 for the reluctance on the part of many transformational grammarians to assume VP embedding), not to mention the vagueness about how the "semantic interpretation rules" work.

2.2. Gaps and FOOT Features

As seen in (3), the subject and/or the object of embedded sentences need not be explicitly mentioned in Japanese. Usually, this occurs when they are identical with the subject or the object of the higher sentences or when they have been mentioned in the previous discourse and are the topic of the conversation.

Note that the gaps are by no means obligatory. We could have inserted a pronoun or a more explicit expression in place of the gaps in the sentences in (3):

(8) a. Ken-wa Naomi-ni {boku / I / zibun / self}-wa moo any_longer soto-wo outside
TOP

arukenai-to itta.
cannot_walk COMP said
'Ken told Naomi that he could no longer walk outside.'

b. Naomi-wa Ken-ni {watasi / I / zibun / self}-wa demo {Ken / kare / he}-wo

TOP nevertheless

aisiteiru-to itta.

love COMP said

'Naomi told Ken that she nevertheless loved him.'

Thus, gaps are optional alternatives for the speaker to avoid mentioning repeatedly the recurrent topic. This is in contrast with the obligatory "missing subject" in the cases of causatives and passives. We couldn't have the "missing subject" position lexically filled:

(9) *Tomio-ga Marie-ni {Marie / kanozyo / she}-ga keeki-wo tukur-ase-ta.

cake make CAUS PAST

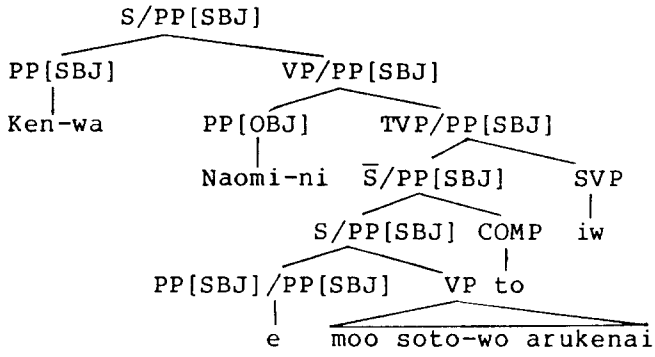
'(intended) Tomio made Marie bake cake.'

With respect to this difference, the embedded seqences in (3) are considered as sentences which optionally lack one or more of the constituents, while what is embedded in causatives and passives is simply a VP, not a sentence which lacks the subject. In this sense, the "missing subjects" are in fact not "missing." They don't exist in the first place.

In the GPSG framework, this kind of difference can be expressed by a FOOT feature SLASH (cf. Gazdar and Pullum 1982). In general, a category is actually a complex symbol of features,

consisting of two major parts: the category proper (denoted by the feature CAT) and the FOOT features. The CAT carries usual information for distinguishing one category from another, e.g., ±N, ±V, lexical or phrasal levels, agreement features, etc. The FOOT features are specified for categories in some distinguished cases, including SLASH and REFL among others. As for the feature value of SLASH, it specifies what is missing in the subtree dominated by the category specified by CAT. For example, consider the category of the embedded sentence in (3a). It is a sentence, but it lacks the subject. In this case, the S category for the node is said to have the feature [SLASH [PP SBJ]]. That is, the feature value for SLASH is PP[SBJ], the subject.[3] For convenience, an S with the feature [SLASH [PP SBJ]] is denoted by S/PP[SBJ]. Similarly for VP/PP[SBJ], PP[SBJ]/PP[SBJ], etc. The phrase structure tree for (3a) is thus as follows. (The detailed structure of topicalization is ignored throughout the paper.)

(10)



Note that the PP[SBJ]/PP[SBJ] dominates a null string, since the entire constituent is missing. Note also that the matrix sentence has the feature [SLASH [PP SBJ]] as well, since it, too, dominates the gap.

Even though gaps can be freely generated at each node, the occurrence of a SLASH feature in phrase structure rules is restricted in a special manner. Note that, in (10), the rules which involves SLASH categories as their daughter categories (e.g., one expanding S/PP[SBJ] and the other expanding VP/PP[SBJ]) have one property in common: the mother categories are also SLASHed. Thus, apparantly, the lowest occurrence of the SLASH feature, i.e., that for the subject PP[SBJ], systematically climbs up the tree to reach the topmost node S. We thus have a general condition on phrase structure rules that if a daughter has a SLASH feature, so does her mother. Since this holds for other FOOT features, one of which, i.e., REFL, will be mentioned later, this principle is generalized as follows:

(11) Foot Feature Principle (FFP)[4]

If a FOOT feature is assigned to a daughter category by free instantiation of the features, the mother category carries all the FOOT features of her daughter categories.

The FFP ensures that the information concerning free gaps is correctly transmitted up the tree. Note that a principle like the FFP is a constraint on possible grammar rules, not on phrase structure trees for some string. The role of the FFP is to effectively restrict possible context-free grammars for a natural language.

2.3. Syntactic vs. Pragmatic Control of Gaps

We have seen in (3) that the subjects of the embedded sentences are not explicitly mentioned in the Japanese sentences, but that they can be identified with the same individuals as the subjects of the matrix sentences. The subject, however, is not the only possible controller of the gap. If an appropriate context is supplied, the gap can be pragmatically controlled by an element outside the sentence. For example, consider (3b). If it is uttered in the context that Naomi had been told by Ken not to see her boyfriend again, then what is actually meant by (3b) is most likely to be that Naomi told Ken that she nevertheless loved her boyfriend, not Ken.

Thus, what we have here is that gaps, which are sometimes controlled pragmatically, can sometimes be controlled intrasententially by the subject of the martix sentence. One might suspect that pragmatic control can also explain such intrasentential interpretations. After all, the default (unmarked) context might be such that the subjects of the matrix sentences are most perspicuous and likely to be picked up as the missing subjects of the embedded sentences. Then, pragmatic control might be all we need to explain the given interpretation.

There is, however, a piece of evidence which suggests that we need more than pragmatic control in order to explain all the cases of control by the subject of the matrix sentence. As Cooper (1979) points out, quantification and pragmatic control interact in an interesting way. Consider the following:

(12) a. Naomi-ga nakidasita. Ken-wa kanozyo-wo nadameta.
began_to_cry TOP she soothed
'Naomi began to cry. Ken soothed her.'

b. Sonoba-ni-ita onna-tati-no hitori-ga nakidasita.
scene at was woman pl of one began_to_cry
Ken-wa kanozyo-wo nadameta.
TOP she soothed
'One of the women who were at the scene began to cry.
Ken soothed her.'

c. Sonoba-ni-ita onna-tati minna-ga nakidasita.
scene at was woman pl all began_to_cry
Ken-wa kanozyo-wo nadameta.
TOP she soothed
'All the women who were at the scene began to cry.
Ken soothed her.'

While, in (12a) or (12b), kanozyo 'she' in the second sentence can refer to the woman mentioned in the previous sentence (specifically Naomi in (12a)), the same pronoun in (12c) cannot refer to a particular woman mentioned in the previous sentence; in fact, the previous sentence doesn't mention any particular woman. The second sentence in (12c) is meaningless unless some additional context supplies the pragmatic controller of kanozyo. Thus, we have a generalization that universal quantifiers don't establish any pragmatic controller, unlike individuals and existential quantifiers.

This generalization leads us to the following criterion: if a gap is controlled by a universally quantified constituent, it must

be syntactically controlled, since there is no possibility for pragmatic control. Now, observe the following:

(13) Sonoba-ni-ita otoko-tati minna-ga Naomi-ni moo
scene at was man pl all any_longer
soto-wo arukenai-to itta.
outside walk COMP said
'All the men who were at the scene said that (they) could no longer walk outside.'

(13) has an interpretation in which the missing subject is controlled by the subject of the matrix sentence. That is, for each man who was at the scene he said that he could no longer walk outside. If pragmatic control were the only control mechanism available, such an interpretation is impossible since, as we have seen, universal quantifiers cannot participate in pragmatic control. This motivates a rule of syntactic control of gaps, which will be formalized in the next section.

Before going there, let us get a more exact characterization of the phenomena. As Kuroda (1965) and Ohso (1976) observe in their transformational analyses of gaps ("zero pronominalization" in Ohso's terminology), subject gaps are only controlled by subjects. Thus, if a universal quantifier appears in the object position, there is no way for the quantifier to control the subject gap, syntactically or pragmatically:

(14) Ken-wa sonoba-ni-ita onna-tati minna-ni moo
TOP scene at was man pl all any_longer
soto-wo arukenai-to itta.
outside walk COMP said
'Ken told all the men who were at the scene that (he) could no longer walk outside.'

In (14), what Ken said is, in direct speech, "I cannot walk outside," not "You cannot walk outside."[5]

Another generalization which goes in parallel with the above is that if the gap occurs in the object position of the embedded sentence, the controller is also the object of the matrix sentence.

(15) Naomi-wa atta otoko-tati minna-ni aisiteiru-to itta.
TOP meat man pl all love COMP said
'Naomi told every man she met that (she) loved (him).'

Note that in (15) the object of aisitei 'love' is missing. This missing object is identified with the object of the matrix sentence in the given interpetation. Since the object is universally quantified in (15), this kind of control must also be syntactic. In this case, the object of the matrix sentence controls the object gap.

Thus, we have the following generalizations:

(16) a. A subject/object gap can be syntactically controlled by the subject/object of a higher sentence.

b. The syntactic control is optional. That is, if the syntactic control is not operative, there is still room for pragmatic control.

In the next section, we will see how these facts can be treated uniformly in the GPSG framework.

3. Control Metarule

3.1. The Metarule

The control phenomena we have seen so far -- reflexivization, subject control of subject gaps, and object control of object gaps -- can be captured by the following single metarule.

(17) Control Metarule (CM)

$$\langle n, [_{[CAT'\ [CAT\ [[-N,\ +V]\ [CASE\ c]]]\ \ X]},\ T\rangle$$
$$[FOOT\ \{[SLASH\ [PP\ [CASE\ c]]],$$
$$[REFL\ [CASE\ c]]\}]]$$

$$\Longrightarrow \langle n, [_{[CAT\ [[-N,\ +V]\ [CASE\ c]]]\ X]},\ T'\rangle$$

where c is a case feature coefficient and T' is obtained from T by binding any free occurrence of r[FOOT] in accordance with Bach's principle.[6]

The basic idea behind (17) is that if a rule for a verbal category such as a VP or a TVP has a FOOT feature such as SLASH or REFL on the mother category, there is also a rule for the same verbal category without the FOOT feature. The daughter nodes for the two rules are identical, but any occurrence of free variables corresponding to the FOOT feature in the translation on the left-hand side is bound in the translation on the right-hand side.

I will assume the following notational convention for free variables corresponding to FOOT features:

(18) u for r[FOOT [SLASH [PP SBJ]]]
v for r[FOOT [SLASH [PP OBJ]]]
z for r[FOOT [REFL SBJ]]

Using these, a free gap or a refelxive is translated into an expression denoting a set of properties of an individual denoted by the free variable. (See the phrase structure rules in the next sections.)

3.2. Reflexivization

Let us examine each instantiation of (17) in turn. The braces give us the choice between the SLASH feature and the REFL feature as the coefficient of the FOOT feature. If it is REFL, the case feature is obligatorily SBJ. Since a [CAT [[-N, +V] SBJ]] is a VP, the mother category of the left-hand side is a VP with the FOOT feature REFL. Let us abbreviate this as VP[REFL]. Then, (17) becomes, in more readable notation:

(19) Reflexivization Metarule (RM)

$\langle n, [_{VP[REFL]}\ X], T\rangle \Longrightarrow \langle n, [_{VP}\ X], T'\rangle$

The semantic part can be obtained as follows. Since the reflexive is translated into the (set of properties of the) free variable r[REFL], i.e., z, T on the left-hand side has a free occurrence of z somewhere. Since T' is to bind this z and have the semantic type of a VP, the appropriate translation will be:

(20) T' = $\lambda p\, p\{\hat{z}T(\hat{}z^*)\}$

Note that Bach's priniciple stipulates that z is bound by the outermost lambda variable, namely, p .

The FOOT feature REFL comes from the reflexive zibun 'self,' which is given by the following lexical rule:

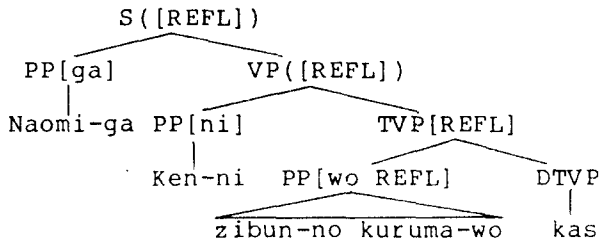
(21) The Reflexive

$$\langle 24, [_{NP[REFL]}\ \underline{zibun}], z^* \rangle$$

The feature REFL is carried over to higher nodes by the Foot Feature Principle (FFP). Thus, a VP[REFL] dominates the reflexive zibun and its translation T has a free occurrence of z. If the right-hand side of the RM is used instead of the left-hand side, the FOOT feature REFL is no longer attached to the VP and correspondingly there is no free occurrence of the reflexive variable z. In this case, the next PP which is given as the argument of the VP controls the reflexive, which is nothing but the subject control of the reflexive. For example:

(22) a. Naomi-ga Ken-ni zibun-no kuruma-wo kasita.
self GEN car lent
'Naomi lent Z's/her car to Ken.'

b.



The translation of the VP[REFL]: Ken-ni zibun-no kuruma-wo kas, if

we use the left-hand side of the RM, is (23a) below, while if we use the right-hand side of the RM, the translation of the VP is (23c). If Naomi is fed to (23a), we get (23b), while (23c) yields (23d):

(23) a. VP[REFL]: $\lambda P P\{\hat{x}$lend(x,k,z's_car)$\}$

b. S[REFL]: lend(n,k,z's_car)

c. VP: $\lambda P P\{\hat{z}$lend(z,k,z's_car)$\}$

d. S: lend(n,k,n's_car)

(23b) is the interpretation where zibun is not bound within the sentence, in which case some pragmatic controller, typically the speaker, can bind the reflexive. Note that the optionality of refelxivization in Japanese corresponds to the very nature of the merarule, which allows both sides of the metarule to coexist in the grammar.

The current approach to reflexivization explains not only the case of coreference in simple sentences as in (22), but also a variety of phenomena concerning reflexivization. Here is the summary:

(24) a. The antecedent can be separated from the reflexive over unlimited number of sentence boundaries. Thus, there is is no clause-mate condition as in English.

b. The controller of the reflexive is normally the preceding and commanding subject. But, there is apparent object control of reflexives in causatives and adversity passives.

c. There are cases of both coreference and disjoint reference of multiple occurrences of the reflexive.

d. There is a possibility of pragmatic control of the reflexive (though idiolectal variation exists).

See Gunji (1983) for a more detailed discussion on reflexivization based on essentially the same formulation as here.[7]

3.3. Subject Control of Subject Gaps

Now, consider the SLASH case. There are two possibilities for the case marker. If it is SBJ, then the mother category for the left-hand side is a VP with the FOOT feature [SLASH [PP SBJ]], i.e., a VP/PP[SBJ]. Then (17) becomes:

(25) Subject Control Metarule (SCM)

$$\langle n, [_{VP/PP[SBJ]}\ X], T\rangle \Longrightarrow \langle n, [_{VP}\ X], T'\rangle$$

The semantic part can be obtained by essentially the same consideration as the case of reflexivization. Thus:

(26) $T' = \lambda p\, p\{\hat{u}T(\hat{}u^*)\}$

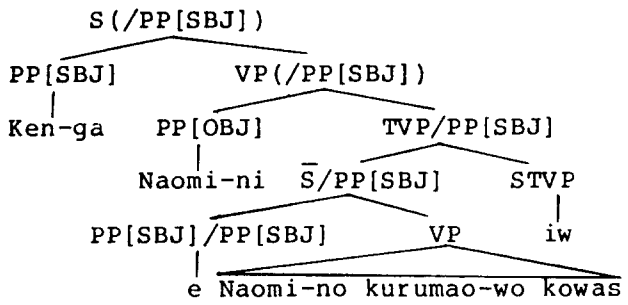
In the case of subject control of subject gaps, we have the following rule to create a gap, which works with the SCM.

(27) Subject Gap

$$\langle 25, [_{PP[SBJ]/PP[SBJ]}\ e], u^*\rangle$$

Except for the fact that subject gaps are invisible, their behavior is exactly like the reflexive. For example:

(28) a. Ken-ga Naomi-ni Naomi-no kuruma-wo kowasita-to itta.
GEN car broke COMP said
'Ken told Naomi that U/he had broken her car.'

b.


The complement of iw in (28) is an $\bar{S}$/PP[SBJ], whose translation is (29a) below. If we use the left-hand side of the SCM at the higher VP node, then the VP/PP[SBJ]: Naomi-ni Naomi-no kuruma-wo kowasita-to iw translates into (29b). When the subject Ken-ga is fed to (29b), the translation of the matrix S/PP[SBJ] becomes (29c), with the gap still remaining and the variable u still free. On the other hand, if we use the right-hand side of the SCM at the higher VP, the translation becomes (29d). Note that u is no longer free in (29d); it is now a lambda-variable. (29d) becomes (29e) given the subject. In this case, the free variable corresponding to the gap is relpaced by the subject, k.

(29) a. $\bar{S}$/PP[SBJ]: break(u,n's_car)
b. VP/PP[SBJ]: $\lambda p p\{\hat{x}$say(x,n,break(u,n's_car))$\}$
c. S/PP[SBJ]: say(k,n,break(u,n's_car))
d. VP: $\lambda p p\{\hat{u}$say(u,n,break(u,n's_car))$\}$
e. S: say(k,n,break(k,n's_car))

Note that (29c) is the interpretation that the missing subject is

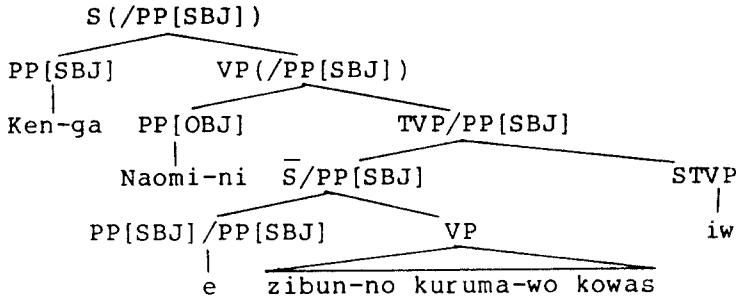
controlled pragmatically, while (29e) is that for syntactic control of the subject gap. As with reflexivization, subject control of subject gaps is optional, which follows from the metarule.

Let us consider here the interaction between the two rules. Consider (30):

(30) a. Ken-ga Naomi-ni zibun-no kuruma-wo kowasita-to itta.
self GEN car broke COMP said
'Ken told Naomi that

{ U had broken Z's car.
U had broken his car.
U had broken U's car.
he had broken Z's car.
he had broken his car. }

b.



There are two VP nodes for which we have choices to use which side of the metarules. The lower VP node gives us two possibilities: which side of the RM to use. If, on one hand, the left-hand side of the RM is used, the upper VP node gives us four possibilities: which side of the RM to use and which side of the SCM to use. On the other hand, if the right-hand side of the RM is used in the lower VP node, the upper VP node gives us two possibilities: which

side of the SCM to use. The following is the summary for the six cases:

(31)

	lower VP RM	upper VP RM	upper VP SCM	translation
a.	L	L	L	say(k,n,break(u,z's_car))
b.	L	L	R	say(k,n,break(k,z's_car))
c.	L	R	L	say(k,n,break(u,k's_car))
d.	L	R	R	say(k,n,break(k,k's_car))
e.	R	-	L	say(k,n,break(u,u's_car))
f.	R	-	R	say(k,n,break(k,k's_car))

Since the translations for cases d and f coincide, there are five different interpretations. Let us consider a context in which Ken and Naomi are talking about their troublesome friend Marie. In this context, (30a) can mean that Ken told Naomi that Marie had broken the speaker's car, which is case a. The car could be Ken's own, which is case c, or even Marie's own, which is case e. The two remaining cases have Ken as the controller of the missing subject. In case b, the car is the speaker's, while in cases d and f, it is Ken's own. These are all and the only possible interpretations of (30a), which are exactly what the current analysis gives.

There have been transformational analyses of the phenomena of subject control of subject gaps (cf. Kuroda (1965) and Ohso (1976)). For example, Ohso (1976) characterizes the phenomena as "zero pronominalization" and gives a rule of deletion of the subject of the embedded sentence under identity with the subject of the matrix sentence. Thus, (28a) would be derived from the

following deep structure:

(32) Ken Naomi [$_S$ Ken Naomi-no kuruma kowas] iw.

As is typical with an analysis in which a full NP is deleted or rewritten, such a transformational analysis would face a serious problem; it has to derive (33b) and (33c) from (33a), which are not synonymous.

(33) a. Subeteno otoko-ga Naomi-ni subeteno otoko-ga
every man every man
kanozyo-wo aisiteiru-to itta.
she love COMP said.
'Every man told Naomi that every man loved her.'

b. Subeteno otoko-ga Naomi-ni kanozyo-wo asiteiru-to itta.
every man she love COMP said
'Every man told Naomi that U/he loved her.'

c. Subeteno otoko-ga Naomi-ni zibun-ga kanozyo-wo
every man self she
aisiteiru-to itta.
love COMP said.
'Every man told Naomi that Z/he loved her.'

Note that, as Hasegawa (1980) argues, the pair of (33a) and (33c) is another counterevidence to deriving the reflexive from a full NP.

In more recent transformational frameworks, subject gaps (and reflexives) are generated at the base. For example, Inoue (1978) specifies a "PRO" at the position of a gap and let her interpretation rule assign the antecedent. In such an approach, one still needs a

rule to delete the PRO after the semantic interpreation is performed (however general such a rule is claimed to be). The subject/object gap approach taken here is different from the interpretive transformational approach in that all the necessary information is supplied as a feature of the relevant nodes, and hence there is no need for the abstract place holder such as PRO, or its deletion mechanism. Moreover, the distinction between the subject gap and the object gap is readily available in our feature formalization. Note that this distinction is crucial in determining the antecedent of the gap (cf. (16)).

3.4. Object Control of Object Gaps

The third and final case is obtained by picking OBJ as the case feature. This time, the mother category for the left-hand side is a TVP with the FOOT feature [SLASH [PP OBJ]]. Thus, (17) becomes:

(34) Object Control Metarule (OCM)

$$\langle n, [_{TVP/PP[OBJ]}\ X], T\rangle \Longrightarrow \langle n, [_{TVP}\ X], T'\rangle$$

T' in (34) now has to bind $\underline{y}$ and have the semantic type of a TVP. Thus, the appropriate form is:

(35) $T' = \lambda Q \lambda p\, Q\{\hat{v}T(p, \hat{}v^*)\}$

Note that Bach's principle is again operative here, since $\underline{y}$ is bound by the outermost lambda variable Q, rather than p. In fact, if it were not for Bach's principle, we couldn't have a unique form for T' in (34).

The OCM works with the lexical rule (36) below which introduces an object gap:

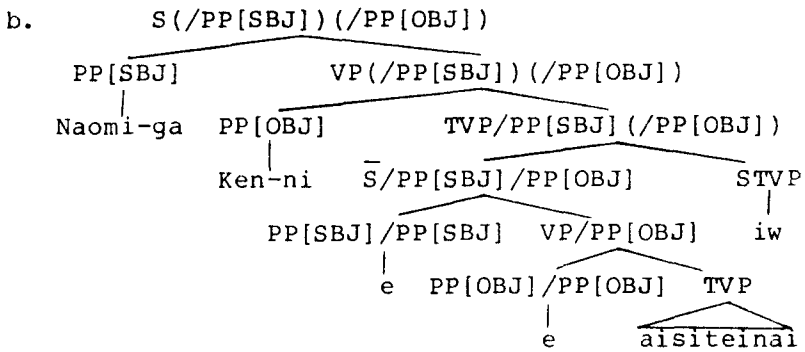
(36) Object Gap

<26, [$_{PP[OBJ]/PP[OBJ]}$ e], v*>

As with the reflexive and the subject gap, the feature [SLASH [PP OBJ]] is carried over to higher nodes by the FFP. For example:

(37) a. Naomi-ga Ken-ni moo aisitei-nai-to itta.
any_more love not COMP said
'Naomi told Ken that (she) didn't love (him) any more.'

b.



(In the tree and the logical translations, moo 'any more' is omitted for simplicity.) The complement of iw in (37) is an S̄ with two gaps -- both at the subject position and at the object position. The object gap has a chance to be bound at the higher TVP node, while the subject gap can be bound at the higher VP node. Thus, there are four possibilities:

(38)	higher TVP OCM	higher VP SCM	translation
a.	L	L	say(n,k,~love(u,v))
b.	L	R	say(n,k,~love(n,v))
c.	R	L	say(n,k,~love(u,k))
d.	R	R	say(n,k,~love(n,k))

All of the interpetations are possible if pragmatic controllers of the gaps are supplied for the first three cases. Consider the following contexts. For case a, Naomi and Ken are talking about their close friends, Tomio and Marie. They know that Tomio and Marie were once passionate lovers, but they don't seem to be seeing each other recently. Ken worries and asks Naomi if she knows how Marie thinks of Tomio these days... Under this context, (37) can mean that Naomi told Ken that Marie didn't love Tomio any more. As for case b, if Ken is curious about what his one-time love, Marie, now thinks of him and asks her close friend, Naomi, (37) can now mean that Naomi told Ken that Marie didn't love Ken any more. Similarly, for case c, if Ken asks Naomi on behalf of his close friend Tomio whether Naomi still loves her one-time lover Tomio, (37) can mean that Naomi told Ken that Naomi didn't love Tomio any more. Finally, no special context is required for case d; Ken is simply asking Naomi if she still loves him.

Thus, (37) is four-ways ambiguous, which comes from the fact that the subject gap and the object gap each has two possibilities: whether it is controlled syntactically or pragmatically.

4. Conclusion

In this paper, I have discussed control phenomena in Japanese in terms of Bach's principle.

In Section 2, we have first seen one kind of object control, which appears in constructions with an embedded VP and is obligatory. We have also seen another kind of control, whose occurrence is not necessarily tied to particular constructions and which can be both syntactic and pragmatic. The difference between the two kinds is that in obligatory object control, Bach's principle is incorporated in the phrase structure rules themselves, while in the case of optional control metarules of gaps and reflexives, Bach's principle works as a guideline to get alternative phrase structure rules. That is, the "missing subjects" of embedded VPs in causatives and passives are immediately controlled by the object of the next higher sentence, and there is no room for control by other higher objects or pragmatic control. On the other hand, gaps and reflexives created as the result of free instantiation of the FOOT features may enjoy being uncontrolled all the time, letting pragmatics to finally control them. If they choose to be syntactically controlled at some VP or TVP node, the control metarule specifies that Bach's principle is what they ought to follow. That is, object gaps are controlled by the object of a higher sentence since they are bound at the TVP level, while subject gaps and reflexives are controlled by the subject of a higher sentence since they are bound at the VP

level.

The GPSG treatment of these control phenomena exhibited in Section 3 utilizes the concept of metarule, which relates phrase structure rules, instead of relating phrase structure trees as transformations. In this way, the GPSG framework, which is essentially context-free syntax coupled with model-theoretic semantics, has been shown to be remarkably suitable for describing control phenomena in Japanese; in fact, a single metarule is sufficient to handle all the cases of optional control of gaps and reflexives.

NOTES

[1]Since VP embedding is assumed here, instead of S embedding as in traditional transformational analyses, the phrase "missing subject" is used only figuratively (hence it always appears between double quotes); the reader should not take seriously that there is indeed something "missing."

[2]As Brame (1975, 1976) points out concerning the controversy over VP complements, assuming VP complements will eliminate the need for many of the familiar cyclic transformations such as tough-movement, raising, equi-NP deletion, etc. This might not be welcomed by transformationalists since it reduces most of the motivations of having a transformational component in the grammar. Note also that to construct a compositional semantics for structures with embedded VPs is no problem in GPSG thanks to lambda abstraction. I am grateful to Gerald Gazdar for bringing my attention to Brame's works. See also his comments in Gazdar (1982).

[3]In general, the feature [A B] is interpreted as the feature with its name A and its coeffiecient (value) B. B can in turn be another feature of the form [C D]. [A B] is often written as A[B] also. See Gazdar and Pullum (1982) for a full description of the notation.

[4]This is a much simplified statement. See Gazdar and Pullum (1982) for a more precise definition based on more formal concepts.

[5]If the object is not a universal quantifier, there is still a possibility for pragmatic control. Thus, (i) below could mean that Naomi said, "You can no longer walk outside."

(i) Naomi-ga Ken-ni moo soto-wo arukenai-to itta.
any_longer outside cannot_walk COMP said
'Naomi told Ken that she/he could no longer walk outside.'

[6]The category is expressed by the combination of the ±N, ±V features and the case feature. As with most of the X-bar frameworks, [+N, -V], [-N, +V], [+N, +V], and [-N, -V] correspond to categories NP, VP, AP, and PP, respectively. I am assuming the case feature system [CASE {SBJ, OBJ, ...}]. That is, the case feature c is one of SBJ (for subject), OBJ (for object), etc. Each of them has a coefficient depending on which case marker is used to specify the case. The possible values are [SBJ {ga, ni}], [OBJ {ni, wo, ga}], etc. If there is no fear of confusion, these are simply denoted as ga, ni, etc. In order to make a distinction between a VP (intransitive) and a TVP (transitive), which is essential in the current discussion, I will employ the case features also as an agreement feature. Since a VP forms a sentence with a PP[SBJ], category VP is specified by the feature [CASE SBJ]. Likewise, category TVP is given the feature [CASE OBJ], since it forms a VP with a PP[OBJ]. Thus, a [CAT [[-N, +V] [CASE SBJ]]] is a VP and a [CAT [[-N, +V] [CASE OBJ]]] is a TVP.

[7]See also Miyara (1981) and Sugimoto (1982), which are both within the Montague grammatical framework. Interestingly, the former is interpretivistic and the latter transformationalistic. These recent formalizations, as well as Hasegawa (1981)'s, crucially depend on the existence of the VP node in the phrase structure, which has not necessarily been very popular among transformational grammarians.

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