Parasitic gaps in Japanese: An MG-based approach

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Abstract

This paper aims to provide an account based on Minimalist Grammar (MG) for what are called parasitic gaps in Japanese, which we take as a null pronoun. The main goal of this paper is to provide a syntactic account of the environment in which a parasitic gap reading is licensed in Japanese. First, Japanese parasitic gaps are compared with English ones, illustrating the puzzle to be solved. We argue that the possibility of co-indexing between a parasitic gap (null pronoun) and wh-phrase is correlated with the point at which the wh-phrase enters the derivation. We also show that scrambling counterbleeds licensing of parasitic gaps by using extended Directional Minimalist Grammar. The proposed syntactic analysis has an advantage over a semantic analysis in that there is no need to postulate vacuous movement of the subject wh-phrase.

1 Introduction

Minimalist Grammar (MG, Stabler, 1997a,b) has been mainly applied to Indo-European languages (especially English), although it was inspired by Chomsky's influential work (Chomsky, 1995), which has been cited in "minimalist" syntax works on various languages. In this paper, we attempt to apply MG to explain a phenomenon in Japanese that is substantially different from that in English. This phenomenon is a parasitic gap construction, which has been vigorously explored in both the Japanese and English syntax literature, including one based on MGs. Adopting the idea that Japanese parasitic gaps are null pronouns, we propose that the c-command relation in the derivation is key to explaining the confounding behavior in the co-indexed reading between a *pro* and wh-phrase in Japanese.

The remainder of this paper is structured as follows: Section 2 provides a basic background on the phenomenon of interest. Section 3 introduces the basic tools used in the proposed analysis, i.e., Directional Minimalist Grammar with some extensions. Section 4 proposes our generalization on how the derivation accounts for a possible co-index configuration. We discuss the proposed analysis and compare it with formalism in other MG literature and with other works on Japanese and English parasitic gaps in Section 5. Section 6 concludes the article with implications for future research.

2 Background: "Parasitic gaps" in Japanese

This section provides a general background on parasitic gaps in Japanese. There are several approaches to Japanese parasitic gaps, but in this paper, we take a null pronominal account as a starting point. This assumption already suggests that the parasitic gaps in Japanese are radically different from those in English. Nevertheless, there is one common feature between the two languages, namely, obligatory movement, and we introduce the puzzle of co-indexation. A short introduction of other characteristics of Japanese parasitic gaps follows before providing a formal tool.

2.1 Nature of parasitic gaps in Japanese and the co-indexation problem

A parasitic gap *pg* is defined as a gap that requires another gap to be grammatical. A typical example in English from Engdahl (1983, 5) is shown in (1). The parasitic gap is inside a syntactic island indicated by square brackets.

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(1) Which article$_i$ did John file t_i [without reading pg_i]?

Several languages are reported to have parasitic gaps. Japanese is one of them, and there have been debates over the nature of parasitic gaps in Japanese (Abe, 2011; Takahashi, 2006; Yoshimura, 1992). When there is a gap in Japanese, we have multiple candidates: a trace of null operator movement, the result of ellipsis, or a null pronoun *pro*. In this paper, we take the last approach by Hirayama (2018), which follows Yoshimura (1992).

An example sentence with a parasitic gap in Japanese is shown in (2), which has a gap inside the subject island. The sentence involves a movement of *wh*-phrase *dare-o*. This interrogative sentence can be used to identify a poor man criticized by a person they met for the first time.

(2) Dare$_i$-o [hazimete pg_i atta hito]-ga t_i kenasimasitata ka?
who-ACC for the first time saw person-NOM criticized Q
'Who was it that a person who saw *pg* for the first time criticized t?'

Note that (2) also has a reading where a parasitic gap and *dare* 'who' refer to different individuals. In this case, a parasitic gap refers to a contextually salient entity. Throughout this paper, our focus is on whether a parasitic gap inside an island and the wh-phrase can refer to the same entity. In other words, we explore the environment where a wh-phrase and parasitic gap may be co-indexed.

As we will see in detail later, there are numerous differences between parasitic gaps in Japanese and English, as pointed out by Hirayama (2018). These distinct characteristics suggest that Japanese parasitic gaps are completely different from English ones, and Japanese parasitic gaps should not even be named as such. However, there is one striking similarity; parasitic gaps are licensed by overt movement of the wh-phrase in Japanese as well as in English. The sentence (3a) (Engdahl, 1983, 14) is ungrammatical under the interpretation where the parasitic gap and wh-phrase refer to the same entity, and this is due to the wh-phrase *which article* staying in-situ. The ungrammaticality under the co-indexed reading is obtained in the Japanese example (3b), where the wh-phrase *dare-o* 'who-ACC' stays in-situ. Note that the representative example we saw in (2) is derived from (3b) by moving the wh-phrase from the base-generated position to the sentence-initial position.

(3) a. * I forget who filed which articles$_i$ without reading pg_i
b. * [Hazimete pg_i atta hito]-ga dare$_i$-o kenasimasita ka?
for the first time saw person-NOM who-ACC criticized Q
(Intended:= (2))

The Japanese example poses a question. In general, Japanese wh-phrases can stay in situ but can scope over syntactic islands except for wh-islands (Shimoyama, 2006), as shown by (4). In the example, even though the wh-phrase is in the adjunct island, the whole sentence can be interpreted as a matrix question.

(4) Taroo-wa [Hanako-ga nani-o tabeta kara] okotta no?
Taro-TOP Hanako-NOM what-ACC ate because got angry Q
'For which x did Taro get mad because Hanako ate x?

Furthermore, Japanese null pronouns in a syntactic island can be co-indexed with a DP in a matrix clause without movement, as shown in (5). Note that in the English translation, an overt pronoun is obligatory to obtain the intended reading.

(5) Taroo-wa [*pro*$_i$ tabe-zuni] keeki$_i$-o suteta.
Taro-TOP eating-without cake-ACC threw away
'Taro threw away the cake$_i$ without eating it$_i$/*$\emptyset_i$.'

Here is the puzzle: Why is a null pronoun inside the island unable to be co-indexed with the in-situ wh-phrase in (3b)? The semantics of questions allows the wh-phrase to scope over the island. Furthermore, no movement is necessary for a DP to bind a pronoun in (5). Hirayama (2018) gave an answer to this question based on the semantics of questions in Japanese, but in this paper, we try to give an answer from a syntactic perspective.

2.2 Other properties of parasitic gaps in Japanese

Hirayama (2018) summarized the difference between the parasitic gaps in Japanese and English, as shown in Table 1. Among them, the first three differences between English and Japanese are important to account for co-variation readings of Japanese parasitic gaps in this paper. They altogether indicate that the configurational requirement of co-indexation of a parasitic gap and the wh-phrase is looser than the environment where English parasitic gaps are licensed; the co-indexed reading is obtained as long as the wh-phrase c-commands the parasitic gap in the surface order.

First, only A'-movement can license English parasitic gaps, as shown by the ungrammaticality of the passive sentence in (6) (Engdahl, 1983, 13). By contrast, (2) involves clause-internal scrambling, which can be A-movement (Saito, 1992), and the co-indexed reading is available.

(6) * John$_i$ was killed t_i [by a tree falling on pg_i].

Next, we have seen that in-situ wh-phrases can never license parasitic gaps in English. As shown in the last section, this is the same in Japanese in most cases. However, when the subject is the wh-phrase, no movement is necessary to obtain the co-indexed reading, as shown in (7) (Hirayama, 2018, 7). Furthermore, (7) also indicates that the anti-c-command condition does not hold in Japanese. The anti-c-command condition states that a real trace cannot c-command a parasitic gap. In other words, the English translation in (7) is ungrammatical.

(7) Dono gakusee-ga Hanako-ni
which student-NOM Hanako-by
[Taroo-ga pg_i sagasu mae-ni]
Taroo-NOM look for before
mitukatta no?
found Q
'Which student$_i$ t_i got found by Hanako before Taro looked for pg_i?'

To summarize, the co-indexed reading in Japanese can be licensed as long as the wh-phrase c-commands *pro*. The type of movement does not matter. The anti-c-command condition does not apply in Japanese, and consequently, it is possible for the subject to be the wh-phrase, and *pro* may be co-indexed with it. Next, we introduce the formalism used in our analysis to account for the characteristics of Japanese parasitic gaps.

3 Directional Minimalist Grammar

A *Minimalist Grammar* (MG, Stabler, 1997a,b) is a mathematically rigorous lexicalized grammar formalism suitable for implementing modern syntactic theory in the (early) *Minimalist Program* (Chomsky, 1995).

An MG contains a set of *lexical items*, each carrying a list of features. For example, a transitive verb *praised*$_{\texttt{=D,=D,V}}$ carries a list of features =D, =D, V, where =D is a *selector* of some DP and V a *category*. Intuitively, each structure-building operation is driven by a feature; **merge** saturates a category b with the corresponding selector =b, combining two expressions (lexical or phrasal) and building a new phrasal expression.

Some variants of MG assume **adjoin** and **scramble** (Frey and Gärtner, 2002), which allow us to perform the adjunction and scrambling operations on that MG. Kobele (2010) also introduces operations called **assume** and **discharge**.

	Eng	Jpn
Must the antecedent be in an A'-position?	Yes	Could be A-position
Can in-situ wh-phrases license pgs?	No	Subject wh does not need movement
Does the anti-c-command condition hold?	Yes	No (the wh must c-command a pg)
Is a pg island sensitive?	Yes	No
Is there Case-matching Effect?	-	No
What category can be a pg?	NP	NP and PP

Table 1: Characteristics of Japanese parasitic gap constructions (adapted from Hirayama, 2018)

3.1 Syntactic object

We assume that every syntactic object is a pair $\langle \mathrm{A}, \phi \rangle$. A represents a lexeme or binary branching phrasal tree $[\ \Gamma\ \Delta\ ]$, where Γ and Δ are left and right subtrees (= syntactic objects), respectively, and ϕ is a label, namely an unsaturated feature bundle. We will write them as A_ϕ. Let us denote by $\mathrm{A} = \langle \mathrm{A}, \emptyset \rangle$ a syntactic object that no longer moves in the course of the derivation. Let us write $\mathrm{A}\langle \Gamma \rangle_\gamma$ as a syntactic object that contains an occurrence of a syntactic object Γ, where $\mathrm{A}\langle \_ \rangle_\gamma$ is called a *syntactic context*, an object equivalent to the syntactic object $\mathrm{A}\langle \Gamma \rangle_\gamma$ except an empty placeholder _ which replaces exactly one occurrence of Γ. This definition is extended later in the paper.

3.2 Merge

The standard MG only allows the head-initial phrase, according to Kayne (1994). However, the order of Japanese words appears to be head-final. Therefore, the domain of **merge** contains a lexical item that can select its complement on the left side. In other words, each word specifies a linear order in the result of **merge** (Stabler, 2011).

(8) a. $\textbf{merge}\,(\mathrm{A}_{\mathtt{X},\gamma}, \mathrm{B}_{<\mathtt{X},\phi}) = [\ \mathrm{A}_\gamma\ \mathrm{B}\ ]_\phi$
b. $\textbf{merge}\,(\mathrm{A}_{\mathtt{X},\gamma}, \mathrm{B}_{>\mathtt{X},\phi}) = [\ \mathrm{B}\ \mathrm{A}_\gamma\ ]_\phi$

In (8), we give the general definition of **merge** in the DMG. $\mathrm{A}_{\mathtt{X},\gamma}$ has the leftmost category $\mathtt{X}$, while $\mathrm{B}_{<\mathtt{X},\phi}$ has the leftmost selector $<\mathtt{X}$ in (8a) and $\mathrm{B}_{>\mathtt{X},\phi}$ has the leftmost selector $>\mathtt{X}$ in (8b). They comprise a new syntactic object labeled ϕ through **merge**, saturating the leftmost selector feature with a corresponding category feature. Because Japanese word order is supposed to be strongly head-final, we mainly use the rule (8a).

3.3 Move

The MG also has an operation called **move**, which cashes out the displacement. This operation is driven by some (*move*) *licensor feature* $+\mathtt{y}$ and the corresponding *licensee feature* $-\mathtt{y}$.

(9) $\textbf{move}\,(\mathrm{A}\langle \mathrm{B}_{-\mathtt{y},\delta} \rangle_{+\mathtt{y},\phi}) = [\ \mathrm{B}_\delta\ \mathrm{A}\langle \epsilon \rangle\ ]_\phi$

In (9), a syntactic object A carries the leftmost licensor $+\mathtt{y}$, and a subtree B carries the corresponding leftmost licensee $-\mathtt{y}$. Then, B moves to the specifier position of A, saturating A's $+\mathtt{y}$ feature with B's $-\mathtt{y}$ feature and leaving a phonologically empty element ϵ. If δ is not empty, B continues to move.

Covert movement in MG is similar to *feature movement* and is defined below (10). In this paper, a designated licensee $-\mathtt{q}$ always denotes a covert movement feature.

(10) $\textbf{move}\,(\mathrm{A}\langle \mathrm{B}_{-\mathtt{q},\delta} \rangle_{+\mathtt{q},\phi}) = [\ \epsilon_\delta\ \mathrm{A}\langle \mathrm{B} \rangle\ ]_\phi$

3.4 First extension: Adjoin and Scrambling

In addition to **merge** and **move**, here we assume two operations called **adjoin** and **scramble**, which are introduced by Frey and Gärtner (2002). Like **merge** and **move**, these are binary and unary operations invoked by different features. In **adjoin** an *adjoin licensor* $\mathtt{»X}$ selects a category $\mathtt{X}$ but does not saturate it.

(11) $\textbf{adjoin}\,(\mathrm{A}_{\mathtt{X},\delta}, \mathrm{B}_{\mathtt{»X},\eta}) = [\ \mathrm{B}_\eta\ \mathrm{A}\ ]_{\mathtt{X},\delta}$

scramble is invoked by a feature called *scramble licensee* $\mathtt{\tilde{}X}$, which behaves like an adjoin licensor, except that deletion of a scramble licensee is optional.

(12) **scramble** $(\mathrm{A}\langle \mathrm{B}_{\tilde{}\mathtt{x},\eta}\rangle_{\mathtt{x},\delta}) = [\ \mathrm{B}_{(\tilde{}\mathtt{x})\eta}\ \mathrm{A}\langle \epsilon \rangle\ ]_{\mathtt{x},\delta}$

3.5 Second extension: Slash-Feature Percolation

We adopt additional operations proposed by Kobele (2010) as *Slash-Feature Percolation*. In this approach, in addition to **merge-move** and **adjoin-scramble**, we assume two further operations: **assume** and **discharge**. First, a unary operation **assume** takes a syntactic object with a selector $>\mathtt{X}$ and adds a new moving syntactic object called *assumption*, which is a 'dummy lexeme' $[\mathtt{X}, \delta]$ carrying a sequence of (move and scramble) licensees δ.

(13) **assume** $(\mathrm{A}_{<\mathtt{x},\phi}) = [\ [\mathtt{X}, \delta]_\delta\ \mathrm{A}\ ]_\phi$

The syntactic object containing some assumption coming from (13) can be regarded as some syntactic context $\Gamma\langle\_\rangle$ whose gap is occupied with that assumption. Note that if some syntactic context $\mathrm{A}\langle[\gamma]_{\simeq\mathtt{y},\delta}\rangle_\phi$ that contains some assumption whose leftmost feature is $\simeq\mathtt{y}$ (a move or scramble licensee) undergoes **move** or **scramble**, then the licensee $\simeq\mathtt{y}$ in $\simeq\mathtt{y}, \delta$ is consumed but $\simeq\mathtt{y}$ in the dummy lexeme $[\gamma]$ remains.

The other binary operation **discharge** takes a syntactic object with *assumption* and a corresponding object.

(14) **discharge** $(\Gamma\langle[\gamma, -\mathtt{y}]_{-\mathtt{y}}\rangle, \mathrm{B}_{\gamma,-\mathtt{y},\delta}) = \Gamma\langle \mathrm{B}_{-\mathtt{y},\delta}\rangle$

This operation replaces an assumption in some syntactic context with some syntactic object. However, we must modify this rule because (i) Kobele (2010, 2012) did not introduce scrambling features and, (ii) as Kobele (2012) wrote, the **assume-discharge** framework can cause an explosion of ambiguous derivations for a single sentence. To avoid these problems, we propose that **discharge** must be applied if and only if a syntactic object contains a gap filled with an assumption that has just deleted some move or scrambling licensee via movement and only carries a single move or scramble licensee $[\gamma, \simeq\mathtt{y}]_{\simeq\mathtt{y}}$, where $\simeq\mathtt{y}$ stands for a move or scrambling licensee. That is, **discharge** only targets some syntactic context with an assumption that moves to the left edge of the tree.[1]

(15) **discharge** $([\ [\gamma, \simeq\mathtt{y}]_{\simeq\mathtt{y}}\ \mathrm{A}\ ]_\phi, \mathrm{B}_{\gamma,\simeq\mathtt{y},\delta}) = [\ \mathrm{B}_{\simeq\mathtt{y},\delta}\ \mathrm{A}\ ]_\phi$

Definition 3.1. A *Directional Minimalist Grammar with Adjunction, Scrambling, assume, and discharge* $G_{\mathcal{P}}$ is a tuple $(\Sigma, B, F, \Lambda, c, \mathcal{P})$, where Σ is a set of (possibly phonetically empty) *words*; B a finite set of *category features*; F a finite set of *licensing features*; Λ a finite set of *lexicon*, whose element, a *lexical entry*, is a pair of a lexeme; and a sequence of features $\phi \in (B_= \cup F_+)^*\, B \cup B_\approx\, (F_- \cup B_\sim)^*$, where $B_= = \{\mathtt{>b}, \mathtt{<b} \mid \mathtt{b} \in B\}$ is a finite set of *selection features*, $B_\approx = \{\text{»}\mathtt{b}, \text{«}\mathtt{b} \mid \mathtt{b} \in B\}$ is a finite set of *adjunction features*, $F_+ = \{\mathtt{+f} \mid \mathtt{f} \in F\}$ is a finite set of *licensor features*, $F_- = \{\mathtt{-f} \mid \mathtt{f} \in F\}$ is a finite set of *licensee features*, and $B_\sim = \{\tilde{}\mathtt{b} \mid \mathtt{b} \in B\}$ is a finite set of *scrambling licensee features*, respectively, $c \in B$ a start category, and $\mathcal{P}$ a finite set of unary and binary operations shown below.

$$\mathcal{P} = \{\textbf{move}, \textbf{scramble}, \textbf{assume}, \textbf{merge}, \textbf{adjoin}, \textbf{discharge}\}$$

4 Analysis

Kobele's unified approach gives us multiple ways to derive an English sentence such as *Who criticized Diego?* For instance, *who* in the sentence can be inserted at different timings, providing three possible derivations. In the case of Japanese, we argue that the possibility of co-indexation of the wh-phrase and *pro* in the island is correlated with the point at which it enters the derivation. Our generalization is given in (16).

[1] This restriction may seem to spoil an analysis in the original work on slash feature percolation (Kobele, 2012). However, if the overt QR proposed by Hornstein (1995) is adopted, our proposal does not affect his analysis.

file: $\text{tozi}_{\texttt{<d,V}}$
v: $\epsilon_{\texttt{<V,<d,v}}$
Taro-TOP: $\text{Taroo-wa}_{\texttt{d,-top}}$
T: $\text{ta}_{\texttt{<v,t}}$
C$_{\mathbf{Q}}$: $\text{no}_{\texttt{<t,+top,+q,c}}$
what-ACC: $\text{nani-o}_{\texttt{d,\~{}t,-q}}$
what-ACC: $\text{nani-o}_{\texttt{d,-q}}$

Figure 1: Example of Japanese lexicon

(16) A *pro* may have the same index as that of a wh-phrase when the wh-phrase c-commands it when it **first** entered the derivation.

We now show how our grammar can produce our sentences of interest. The contrast to be shown is the one seen between (17) and (18). In (17), there is no movement of the wh-phrase, and the sentence is ungrammatical under the co-indexed reading. In (18), the wh-phrase is moved and therefore we can get the parasitic gap interpretation.

(17) * Taroo-wa [pg_i yomazu-ni]
Taro-TOP read.NEG-with
nani$_i$-o tozita no?
what-ACC filed Q
'What$_i$ did Taro file without reading it$_i$.'

(18) Taroo-wa nani$_i$-o [pg_i
Taro-TOP what-ACC
yomazu-ni] t_i tozita no?
read.NEG-with file Q
'What$_i$ did Taro file without reading it$_i$?'

We introduce our lexicon to derive toy-set examples of Japanese sentences given in Figure 1. Here, we ignore case features as they are irrelevant to our discussion.

We assume a subordinate small clause with a parasitic gap in (19) to simplify the discussion.

(19) ***pro* read.without**: [*pro* yomazuni]$_{\texttt{»v}}$

The derivation steps and a derivation tree in each step of (17), the sentence without scrambling, are shown in Figure 2 and Figure 3, respectively.

First, let us show how the derivation proceeds using derivation trees in Figure 3. (17), which does not involve the overt movement of the wh-phrase, cannot have a co-indexed reading. There are two possible derivations to get this sentence.

The first possibility is the case where the wh-phrase is merged with the verb first, as shown in Figure 3. This sentence can never obtain the co-indexed reading due to (16), i.e., the wh-phrase enters earlier than a *pro* and cannot c-command it. The derivation itself can converge, but the sentence does not have the "parasitic gap" interpretation.

The second possibility is that the object wh-phrase is assumed. In this case, our definition of **discharge** requires the assumption to be discharged immediately because the wh-phrase used in this derivation only has the -`q`-feature. As a result, we have virtually the same structure as in Figure 3. Consequently, the wh-phrase can never c-command the *pro* in the subordinate small clause; hence, the parasitic gap reading is unavailable.

Now let us see the derivation in detail. In Figure 2, because the wh-phrase *nani-o* is immediately merged with the verb in step 1, it cannot c-command the *pro* until it undergoes covert movement in step 8. Although we can apply **assume** to the verb in step 1, the assumption should only have the -`q`-feature to get the desired word order. In this case, our proposal obligates **discharge** to be applied immediately after step 1. That is, the wh-phrase *nani-o* cannot wait for the subordinate clause to be adjoined. In addition, the final result with the covert movement of the wh-phrase creates a WCO environment.

Now, let us consider the grammatical case (18), where the wh-phrase is moved from the base-generated position. The derivation steps and a derivation tree in each step of (18) are shown in Figure 4. and Figure 5 respectively. To allow *pro* to be co-indexed with the wh-phrase, the object DP must be assumed first. After adjoining the *without*-clause and merging T, the assumption is scrambled. After this clause-internal scrambling, the wh-phrase is

1. **merge**(nani-o$_{\texttt{d},\texttt{-q}}$, tozi$_{\texttt{<d},\texttt{V}}$) $=$ [nani-o$_{\texttt{-q}}$ tozi]$_{\texttt{V}}$
2. **merge**$(1, \epsilon_{\texttt{<V},\texttt{<d},\texttt{v}})$ $=$ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]$_{\texttt{<d},\texttt{v}}$
3. **merge**(Taroo-wa$_{\texttt{d},\texttt{-top}}$, 2) $=$ [Taroo-wa$_{\texttt{-top}}$ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]]$_{\texttt{v}}$
4. **adjoin**(3, *pro* yomazuni$_{\texttt{»v}}$) $=$ [[*pro* yomazuni] [Taroo-wa$_{\texttt{-top}}$ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]]]$_{\texttt{v}}$
5. **merge**(4, ta$_{\texttt{<v},\texttt{t}}$) $=$ [[[*pro* yomazuni] [Taroo-wa$_{\texttt{-top}}$ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]]] ta]$_{\texttt{t}}$
6. **merge**(5, no$_{\texttt{<t},\texttt{+top},\texttt{+q},\texttt{c}}$)
   $=$ [[[[*pro* yomazuni] [Taroo-wa$_{\texttt{-top}}$ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]]] ta] no]$_{\texttt{+top},\texttt{+q},\texttt{c}}$
7. **move**(6) $=$ [Taroo-wa [[[[*pro* yomazuni] [ϵ [[nani-o$_{\texttt{-q}}$ tozi] ϵ]]] ta] no]]$_{\texttt{+q},\texttt{c}}$
8. **move**(7) $=$ [ϵ [Taroo-wa [[[[*pro* yomazuni] [ϵ [[nani-o tozi] ϵ]]] ta] no]]]$_{\texttt{c}}$

Figure 2: Derivation of *Taroo-wa yomazuni nani-o tozitano?*

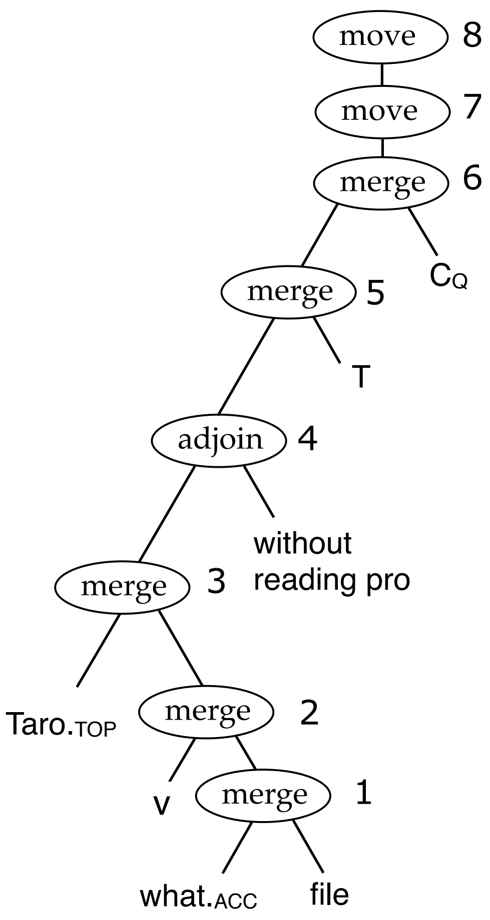

Figure 3: Derivation trees for the sentences without scrambling

discharged. In the final part of the derivation, the q-feature is checked by covert movement. On the surface, we have a weak crossover configuration, but the weak crossover violation is remedied thanks to clause-internal scrambling. In summary, clause-internal scrambling, as A-movement (Saito, 1992), can license null pronouns appearing as parasitic gaps (18) as well as overt pronouns (20).

(20) Taroo-wa nani$_i$-o [soitu$_i$-no
Taro-TOP what-ACC its$_i$
kabaa-goto] t_i tozita no?
cover-with filed Q
'What$_i$ did Taro file t_i with its$_i$ cover?'

In other words, though wh-configuration bleeds the licensing of the co-indexed readings of null pronouns, scrambling can counterbleed licensing of parasitic gaps.

Figure 4 shows that because the assumption is to be scrambled, it has the feature ~t in step 1 and can wait to be discharged later in the derivation in step 7. Consequently, the wh-phrase *nani-o* can c-command the *pro* when it first enters the derivation in the same step.

5 Discussion

Here, we discuss our proposal and compare it with other previous studies on MGs and parasitic gaps. First, the grammar used in this paper is compared with those in the previous studies in terms of the plausibility of the extension. Next, we examine how the proposed analysis is different from (i) the previous studies on parasitic gps using MGs and (ii) Hirayama (2018).

1. $\textbf{assume}(\text{tozi}_{\texttt{<d,V}}) = [[\texttt{d, \~{}t, -q}]_{\texttt{\~{}t,-q}}\ \text{tozi}]_{\texttt{V}}$
2. $\textbf{merge}(1, \epsilon_{\texttt{<V,<d,v}}) = [[[\texttt{d, \~{}t, -q}]_{\texttt{\~{}t,-q}}\ \text{tozi}]\ \epsilon]_{\texttt{<d,v}}$
3. $\textbf{merge}(\text{Taroo-wa}_{\texttt{d,-top}}, 2) = [\text{Taroo-wa}_{\texttt{-top}}\ [[[\texttt{d, \~{}t, -q}]_{\texttt{\~{}t,-q}}\ \text{tozi}]\ \epsilon]]_{\texttt{v}}$
4. $\textbf{adjoin}(3, [\textit{pro}\ \text{yomazuni}]_{\gg\texttt{v}}) = [[\textit{pro}\ \text{yomazuni}]\ [\text{Taroo-wa}_{\texttt{-top}}\ [[[\texttt{d, \~{}t, -q}]_{\texttt{\~{}t,-q}}\ \text{tozi}]\ \epsilon]]]_{\texttt{v}}$
5. $\textbf{merge}(4, \text{ta}_{\texttt{<v,t}}) = [[[[\textit{pro}\ \text{yomazuni}]\ [\text{Taroo-wa}_{\texttt{-top}}\ [[[\texttt{d, \~{}t, -q}]_{\texttt{\~{}t,-q}}\ \text{tozi}]\ \epsilon]]]\ \text{ta}]_{\texttt{t}}$
6. $\textbf{scramble}(5) = [[\texttt{d, \~{}t, -q}]_{\texttt{-q}}\ [[[\textit{pro}\ \text{yomazuni}]\ [\text{Taroo-wa}_{\texttt{-top}}\ [[\epsilon\ \text{tozi}]\ \epsilon]]]\ \text{ta}]]_{\texttt{t}}$
7. $\textbf{discharge}(6, \text{nani-o}_{\texttt{d,\~{}t,-q}}) = [\text{nani-o}_{\texttt{-q}}\ [[[\textit{pro}\ \text{yomazuni}]\ [\text{Taroo-wa}_{\texttt{-top}}\ [[\epsilon\ \text{tozi}]\ \epsilon]]]\ \text{ta}]]_{\texttt{t}}$
8. $\textbf{merge}(7, \text{no}_{\texttt{<t,+top,+q,c}})$
   $= [[\text{nani-o}_{\texttt{-q}}\ [[[\textit{pro}\ \text{yomazuni}]\ [\text{Taroo-wa}_{\texttt{-top}}\ [[\epsilon\ \text{tozi}]\ \epsilon]]]\ \text{ta}]]\ \text{no}]_{\texttt{+top,+q,c}}$
9. $\textbf{move}(8) = [\text{Taroo-wa}\ [[\text{nani-o}_{\texttt{-q}}\ [[[\textit{pro}\ \text{yomazuni}]\ [\epsilon\ [[\epsilon\ \text{tozi}]\ \epsilon]]]\ \text{ta}]]\ \text{no}]]_{\texttt{+q,c}}$
10. $\textbf{move}(9) = [\epsilon\ [\text{Taroo-wa}\ [[\text{nani-o}\ [[[\textit{pro}\ \text{yomazuni}]\ [\epsilon\ [[\epsilon\ \text{tozi}]\ \epsilon]]]\ \text{ta}]]\ \text{no}]]]_{\texttt{c}}$

Figure 4: Derivation of *Taroo-wa nani-o yomazuni tozitano?*

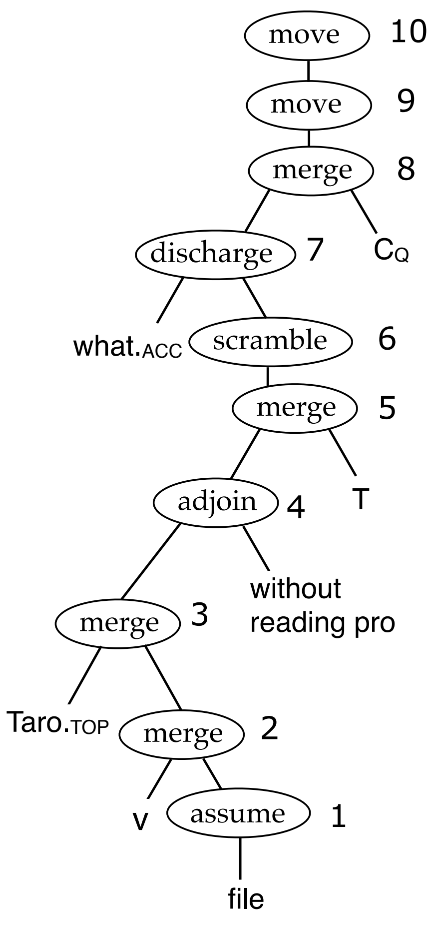

Figure 5: Derivation trees for the sentences with scrambling

5.1 Comparison with the grammars proposed in the previous work

We incorporate several operations for syntax such as **scrabling** or **adjunction**, in addition to **merge** and **move**. The increased number of operations makes the MG's generative capacity obscure. However, it is worth mentioning that the operations are not motivated only specifically for Japanese. Frey and Gärtner (2002) introduce **scrambling** and **adjunction** to treat some phenomena in Indo-European languages. We adopt these operations for the analysis of the phenomenon in non-Indo-European languages. In addition, these operations do not increase derivational ambiguity for a single sentence, as they are driven by features different from **merge** and **move**.

In contrast, **assume** and **discharge** proposed by Kobele (2012) seem unwelcome in some sense that these operations may inconstantly increase the number of ambiguous derivations for a single sentence. However, we reformulated **discharge** (15) in a more restricted way than the original definition; Our definition states that **discharge** must be applied only to the pair of the syntactic context whose specifier position is occupied by the dummy object with an unsaturated feature, and the corresponding object. This leads to a reduction of some ambiguous courses of derivations.

5.2 Comparison with previous work on parasitic gaps with MG

Stabler (2006) and Kobele (2008) proposed MG-based analyses (or equivalent formalisms based) for parasitic gaps in English. Both adopted a derivational model similar to sideward movement. In contrast, our approach is more representational.

5.3 Comparison with Hirayama (2018)

In Section 2.1, we mentioned the approach of Hirayama (2018) is semantic. Her analysis assumes no LF movement of the wh-phrase, and movement is necessary so that a single lambda can bind both *pro* and the trace of the wh-phrase via Predicate Abstraction, as schematically illustrated in (21). After the lambda binds both *pro* and the trace, the wh-phrase can manipulate both values simultaneously. Without a trace, namely, when the wh-phrase stays in situ, it cannot affect the value of *pro* in the semantic computation process.

(21) who ... λ_3 ... [... pro_3] ... t_3

Hirayama's analysis is problematic in explaining the case with the subject wh-phrase. As mentioned earlier, the anti-c-command condition does not hold in Japanese. In other words, the real trace can c-command a parasitic gap in Japanese, as seen in (22):

(22) Dono gakusee-ga Hanako-ni
which student-NOM Hanako-by
[Taroo-ga pg_i sagasu mae-ni]
Taroo-NOM look for before
mitukatta no?
found Q
'Which student$_i$ t_i got found by Hanako before Taro looked for pg_i?'

For Hirayama's semantic analysis to work, there should be a trace of the wh-subject so that we can have the configuration in (21). As she mentions in footnote 9, it is possible to assume a vacuous clause-internal movement of the subject. However, as this is not a weak crossover configuration, nothing motivates the vacuous movement.

By contrast, our analysis only refers to the steps in the derivation to account for the possibility of co-indexation. In the case of (22), the subordinate clause has already entered the derivation, so the subject wh-phrase c-commands it when it enters the derivation. The subject wh-phrase covertly checks the q-feature, but there is no need to assume further scrambling because it is not a weak crossover configuration.

6 Conclusion

We proposed a DMG-based analysis of parasitic gaps in Japanese, using a slash-feature percolation. Though we had observed several exotic properties of parasitic gaps in Japanese, a typical example of non-Indo-European languages, we have shown an extension of the 'minimalist' assumptions to deal with them precisely. The interaction between **discharge** and **scramble** explains that A-movement can counterbleed the WCO effect.

The proposed DMG $G_{\mathcal{P}}$ contains six operations, which makes the generative capacity of this grammar unclear. However, because some properties of the parasitic gaps in Japanese can be explained in the interaction of these operations, these operations appear to be necessary to account for some properties of natural language. More work on a variety of languages by MG would be needed to seek "minimalist" grammar.

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