Plurality and Reciprocity: Support for QR

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February, 2000

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Abstract
This paper aims to give support to the view that Quantifier Raising (QR) plays a crucial role in the computational component $C_{HL}$ of the minimalist architecture proposed by Chomsky (1995). I argue that QR is involved in deriving the cumulative readings of plural sentences and the appropriate interpretations of reciprocal sentences. Under the assumption made by Abe (1993a) that QR is characterized as movement for satisfying the semantic feature [Scope] in a position where a given QP takes scope, it is argued that the proper representations for the cumulative readings of plural sentences are derived by what we call absorption operation, in which one QP is adjoined to another to satisfy its [Scope] and that this adjunction operation is subject to the clause-boundedness and rigidity of QR. Further, I argue, following Heim, Lasnik and May (1991), that reciprocal sentences involve LF adjunction of reciprocals to their antecedents. It is shown that this adjunction operation is subject to rigidity, thus indicating that it is QR, i.e., movement to satisfy a [Scope] feature. This claim is further supported by the fact that some restrictions are operative in deriving both the cumulative reading and one of the reciprocal readings at a time.
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1. Introduction

This paper aims to give support to the view that Quantifier Raising (QR) plays a crucial role in the computational component $C_{HL}$ of the minimalist architecture proposed by Chomsky (1995). Under the minimalist conception of grammar, it is important to consider what triggers QR if such movement exists. If we manage to attribute the triggering to legibility conditions, it will be an optimal solution. In Abe (1993a, 1999a), I proposed, basically adapting May's (1977) original idea under the minimalist framework, that lexical items (LIs) that undergo QR have the property of taking scope and hence cannot obtain a proper interpretation at the interface unless they appear in a peripheral position where they can take scope. Suppose, following Abe (1993a), that these LIs have the semantic feature [Scope] and further that this feature must be licensed in a position where it takes scope over a clause, typically in a TP-adjoined position. Then, in (1), everyone, having the feature [Scope] as its inherent property, undergoes covert movement, as shown in (1b), to satisfy this feature:

(1) a. John hates everyone.
   b. $[TP \text{ everyone}; [TP \text{ John hates } t_i]]$
   $[\text{Scope}]$

In this paper, I argue that QR (namely, such movement as to satisfy [Scope]) is involved in deriving appropriate LF representations for such plural sentences as (2a) and reciprocal sentences as (2b):

(2) a. The women examined the prisoners.
   b. The women examined each other.
It is important to consider what kind of LF representations are assigned to such sentences. One position would be that syntax does not contribute anything to the meaning of plurality and reciprocity, such meanings deriving exclusively from semantic rules. The other position would be that syntax plays an important role in deriving such meanings. The purpose of this paper is to defend the latter position. In so doing, it is necessary to show how LF operations and conditions constrain the LF representations for such sentences as in (2). I rely on two conditions that restrict the application of QR: the clause-boundedness condition and the rigidity condition. It will be shown that these conditions are operative in deriving what is called the cumulative reading of (2a) and the proper reciprocal interpretations of (2b).

Section 2 outlines the mechanism of QR proposed by Abe (1999a), which will constitute the basis of examining the appropriate LF representations for plural and reciprocal sentences. Sections 3 and 4 deal with plural sentences and reciprocal sentences, respectively, showing that their LF representations are constrained by the conditions on QR.

2. QR and Economy Conditions: Abe (1999a)

The crucial assumption which will be adopted throughout this paper is repeated below:

(3) QR: The semantic feature [Scope] must be licensed in a position where it takes scope over a clause.

This is nothing but a reformulation of QR proposed by May (1977) under the minimalist framework. According to this conception, those phrases which carry [Scope] must undergo movement to a clause-periphery position to license this feature. This is intended to capture the idea that quantifier phrases (QPs) will not be appropriately interpreted at the interface unless they move to positions where they take scope. In this respect, it differs from Fox’s (1995) proposal, according to which QR is subject to an economy condition on interpretation, so that it applies only when
it contributes to creating a new scope relation that will not be obtained if QPs stay in situ. Thus, the present theory requires not only everyone in (4) but also everyone in (1b), repeated below as (5), to undergo QR:

(4) \[ TP \text{everyone}_i [TP \text{someone hates } t_i] \]

[Scope]

(5) \[ TP \text{everyone}_i [TP \text{John hates } t_i] \]

[Scope]

While in (4) the application of QR creates the reading in which everyone takes scope over someone, it does not contribute to creating any new meaning in (5) and yet it is necessary to license the [Scope] feature carried by everyone.

Some scholars such as Kitahara (1996) and Hornstein (1995) claim that the effects of QR are derived from the properties of A-movement, so that it should be dispensed with. This is a plausible claim as far as subject QPs are concerned. Let us consider the following example:

(6) \[ TP \text{every boy}_i [vP t_i \text{likes Mary}] \]

[Scope]

Under the predicate-internal subject hypothesis, it is natural to consider that every boy in this representation already occupies a scope-taking position and further that the trace of every boy in Spec-vP can serve the variable position of this QP. This does not mean, however, that we can dispense with all instances of QR. If it is the case that QPs must take scope over TP, then object QPs need to undergo QR, as shown in (4) and (5). Further, as Fox (1995) points out, this enterprise of eliminating QR does not extend to cases where PP is involved in scope ambiguity, nor to cases of inverse linking, etc.

A strong argument for the existence of QR can be provided by showing that QR is subject to the same constraints as the kind of movement that takes place for feature-checking. In Abe (1993a), I showed that QR is subject to economy conditions. The clause-boundedness of QR was taken as one instantiation of such an
economy constraint. Under the present assumption that [Scope] is satisfied by moving it to a TP-adjoined position, every problem in the following example can move to either the embedded TP or the matrix TP, as shown below:

(7) Someone thinks that Mary solved every problem.
   a. someone thinks that [TP every problemi [TP Mary solved t₁]]

   [Scope]

   b. [TP every problemi [TP someone thinks that [TP Mary solved t₁]]]

   [Scope]

In either representation, the feature [Scope] is satisfied, since it occupies a scope-taking position. Given these two options, it is natural to reason that some economy condition chooses (7a) over (7b) as more economical. For instance, in Abe (1993a), I claimed that an economy condition in terms of the length of movement, such as that proposed by Collins (1994), dictates that the movement involved in (7b) is illegitimate, since there is a shorter movement available to satisfy [Scope], namely, the one given in (7a). In Abe (1999a), I proposed the alternative, according to which the clause-boundedness of QR is derived from the economy condition "Minimize Chain Links" (MCL), proposed by Chomsky and Lasnik (1993), which requires that a given movement cannot skip a possible landing site. Given this condition, every problem in (7) cannot license its [Scope] feature in the matrix TP, since the movement involved skips a possible landing site, i.e., the embedded TP-adjoined position, where the QP could satisfy its [Scope]. Hence, the MCL requires that the feature [Scope] must be licensed in the most local TP-adjoined position, thus deriving the clause-boundedness of QR.¹

There is another well-known constraint that applies to QR: the rigidity condition. Japanese is one of the well-attested languages that observe this condition, as shown below:

(8) a. Dareka-ga daremo-o hihansita.
    someone-Nom everyone-Acc criticized
'Someone criticized everyone.'

b. Daremo-o_i dareka-ga t_i hihansita.

everyone-Acc someone-Nom criticized


-Nom someone-Dat everyone-Acc introduced

'John introduced everyone to someone.'

b. John-ga daremo-o_i dareka-ni t_i syookaisita.

-Nom everyone-Acc someone-Dat introduced

Given the standard assumption since Hoji (1985) that the basic word order in Japanese is Subject (SUB)-Indirect Object (IO)-Direct Object (DO), what these sentences show is that when the surface order reflects the basic word order, as in (8a) and (9a), it exhibits so-called "rigidity" in scope interaction; that is, the structurally higher QR must take scope over the lower QP. On the other hand, when the surface order is a derived word order, as in (8b) and (9b), either QP can take scope over the other. This shows that a QP that undergoes scrambling, crossing another QP, makes the scope order ambiguous. In order to capture these facts, let us first assume the following interpretive rules:

(10) a. The scope domain of a [Scope] is its c-command domain.

b. If [Scope]$_i$ asymmetrically c-commands [Scope]$_j$, then [Scope]$_i$ > [Scope]$_j$.

c. If [Scope]$_i$ and [Scope]$_j$ c-command each other, then [Scope]$_i$ >= [Scope]$_j$.

(10a) indicates the absolute scope of a QP carrying [Scope], and (10b) and (10c) indicate relative scopes among QPs carrying [Scope]. We have been assuming that [Scope] is satisfied by moving it to a scope-taking position, a TP-adjoined position or a Spec-TP position. In Abe (1999a), the following qualification is added besides this way of satisfying [Scope]:

(11) [Scope] in situ can be satisfied by means of being bound by another instance of [Scope] that satisfies itself by movement.
It is intended in the above statement that in this way of satisfaction of [Scope], the [Scope] in situ takes the same scope domain as that which licenses it.\textsuperscript{2} Note that in such a case the [Scope] in situ is interpreted as under the scope of the other c-commanding [Scope], according to interpretive rule (10b). This way of licensing is reminiscent of the licensing of wh-phrases in situ proposed by Chomsky (1993): they do not have to move at LF and are construed with appropriate wh-phrases in Spec-CP in some way.

Given these assumptions, (8a), for instance, can have the following LF representations:

(12) \[
\begin{array}{c}
\text{TP dareka-gai} \rightarrow_{1P} t_1 \text{daremo-o hihansita}] \\
\text{[Scope]} \quad \text{[Scope]}
\end{array}
\]

In this representation, the [Scope] feature of \textit{dareka} is satisfied in the Spec-TP position and it also licenses the [Scope] feature of \textit{daremo}, according to (11). This represents the reading in which the subject QP takes scope over the object QP. In order to capture the rigidity effects of scope interaction, it is necessary to exclude such an LF representation as the following, in which \textit{daremo-o} is adjoined to TP to represent the reading in which the object QP takes scope over the subject QP:

(13) \[
\begin{array}{c}
\text{TP daremo-oi} \rightarrow_{1P} \text{TP dareka-gai} \rightarrow_{1P} t_1 \text{hihansita}] \\
\text{[Scope]} \quad \text{[Scope]}
\end{array}
\]

In Abe (1999a), I claimed that the rigidity of QR is derived from Chomsky's (1995) Minimal Link Condition (MLC); that is, in (13), when TP attracts a phrase carrying [Scope], it cannot attract \textit{daremo}, since there is another phrase carrying [Scope] that is closer to it than this object QP, namely, the subject QP \textit{dareka}, hence (13) is in violation of the MLC. To simplify the following discussion, however, let us keep the older framework of movement according to which QR is a case of Move rather than Attract, putting aside the possibility of deriving the rigidity of QR from such an economy condition as the MLC, and let us state the relevant condition as the following:
(14) **Crossing Constraint on QR (CCQR)**

A feature [Scope] \_i cannot cross another feature [Scope] \_j, unless it is carried along as a free ride.

(13) is, then, ruled out by the CCQR since the [Scope] of `daremo` crosses that of `dareka` when it is adjoined to TP.

The *unless*-clause in (14) is necessary to account for the scope ambiguity of (8b) and (9b). To take (8b) for illustration, this sentence can have both (15) and (16) as its legitimate LF representations.

(15) \[ \text{TP daremo-oi [TP dareka-gaj [vP t_j \ t_i \ hihansita]]} \]

\[ \text{[Scope]} \quad \text{[Scope]} \]

(16) \[ \text{TP daremo-oi [TP dareka-gaj [vP t_j \ t_i \ hihansita]]} \]

\[ \text{[Scope]} \quad \text{[Scope]} \]

In (15), the [Scope] feature of `daremo` is left behind by scrambling and is thus licensed by that of `dareka` by way of binding according to (11). This represents the reading in which the subject QP takes scope over the object QP. In (16), even though the [Scope] feature of `daremo` crosses that of `dareka` when it is adjoined to TP, it does not violate the CCQR since the movement in question is that of scrambling and hence the [Scope] feature is carried along as a free ride. (16) represents the reading in which the object QP takes scope over the subject QP. Hence, (8b) is scopally ambiguous with (15) and (16) for its legitimate LF representations of the two readings.

To summarize, QR is characterized as movement for satisfying the semantic feature [Scope] and this feature is licensed in a TP-adjoined or a Spec-TP position where it can take scope. This movement is subject to two conditions; one is the MCL, which derives the clause-boundedness of QR, and the other is the CCQR, which derives the rigidity effects of QR.
3. The Cumulative Reading

In this section, I will argue that QR, as formulated above, is involved in deriving the so-called cumulative readings of plural sentences. In so doing, let us first consider the following sentences:

(17) a. Every woman examined John.
    b. The women examined John.

According to our assumptions on QR, (17a) has the following LF representation:

(18) \[ TP \mathrm{every} \, \mathrm{woman}_i \left[ v \mathrm{P} \, t_i \mathrm{examined} \, \mathrm{John} \right] \]

[Scope]

In Abe (1993a), I claimed that (17b) has the same LF representation as (17a):

(19) \[ TP \mathrm{the} \, \mathrm{women}_i \left[ \, v \mathrm{P} \, t_i \mathrm{examined} \, \mathrm{John} \right] \]

[Scope]

and that plural NPs in such representations are interpreted as in (20), following Higginbotham (1981):

(20) \[ TP \, \mathrm{NP}_i \left[ \ldots \, x_i \, \ldots \right] \mathrm{where} \, \mathrm{NP}_i \mathrm{is} \, \mathrm{a} \, \mathrm{plural} \, \mathrm{NP} \]
    \[ \rightarrow (\exists \, \Pi \, \mathrm{NP}_i)(\forall \, x \, \in \, \Pi)[ \ldots \, x \, \ldots ] \]

where \( \Pi \) represents a partition. Here I assume Higginbotham's (1981) definition of partition:

(21) A \textit{sub-plurality} \( Q \) of a plurality \( P \) is a plurality each member of which is a member of \( P \). A \textit{covering} of a plurality \( P \) is a family \( C \) of subpluralities of \( P \) such that every member of \( P \) belongs to some member of \( C \). A covering \( C \) of \( P \) is a \textit{partition} of \( P \) if the members of \( C \) are pairwise disjoint.

Given this, (17b) is interpreted as follows: there is a partition of the set of women such that each member examined John. Suppose that the women consists of the following three: \{Nancy, Mary, Susan\}. Then, there are five ways to instantiate the semantic interpretation given in (20), depending on how we partition this set: \{Nancy\}\{Mary\}\{Susan\}, \{Nancy\}\{Mary, Susan\}, \{Mary\}\{Nancy, Susan\}, \{Susan\}\{Nancy, Mary\}, \{Nancy, Mary, Susan\}. Among these five choices, the first
is the case where each woman examined John, the last is the case where all the
women examined John together, and the others are in-between cases.

Let us examine the semantics given in (20) more closely. In this formulation,
the interpretation of NP\textsubscript{i} itself is not provided. NP\textsubscript{i} can be all sorts of plural noun
phrases, including generalized quantifiers, as shown below:

\begin{enumerate}
\item \textbf{(All)} the women examined John.
\item Most women examined John.
\item Three women examined John.
\end{enumerate}

Here I follow Barwise and Cooper (1981) in assuming that determiners such as \textit{all},
\textit{most} and \textit{three} are not quantifiers by themselves, but rather characterized as asserting
that the set expressions denoted by N have some properties. Thus, the denotations of
the subject NPs in (22) are informally specified as follows:\textsuperscript{3}

\begin{enumerate}
\item \textit{All} the \textit{N}\textsuperscript{\textit{i}} = \{X \subseteq E | X = A\}
\item \textit{Most} \textit{N}\textsuperscript{\textit{i}} = \{X \subseteq E | X \cap A > 1/2|A|\}
\item \textit{Three} \textit{N}\textsuperscript{\textit{i}} = \{X \subseteq E | X \subseteq A \text{ and } |X| = 3\}
\end{enumerate}

Given this, (20) should be revised as follows when N\textsubscript{Pi} is a generalized quantifier:

\begin{equation}
[TP N\textsubscript{Pi} [ ... x_i ... ]] \text{ where } N\textsubscript{Pi} \text{ is a plural NP}
\end{equation}

\[-\rightarrow \exists X[Q(X, A) \land (\exists \Pi X)(\forall x \in \Pi)[ ... x ... ]]

In what follows, I will use a semantic formulation in terms of (20) for simplicity
unless the more precise one in terms of (24) is necessary.

Let us now consider what Langendoen (1978) calls \textit{elementary plural relation}
\textit{sentences}, such as the following ((25b) is a Japanese translation of (25a)):

\begin{enumerate}
\item The women criticized the men.
\item Sono onna-tati-ga sono otoko-tati-o hihansita.
\end{enumerate}

According to Langendoen, these sentences have the following truth conditions:\textsuperscript{4}
This is what Scha (1984) calls the cumulative reading of plural sentences. To paraphrase these truth conditions, the sentences in (25) are interpreted as follows:

(27) There is a partition $P_1$ of the set of women and a partition $P_2$ of the set of men such that:

a. Each member of $P_1$ criticized some member of $P_2$; and

b. Each member of $P_2$ was criticized by some member of $P_1$.

The sentences in (25) can be true in various situations of the men criticizing the women, according to how we partition the two sets.

Notice that the cumulative reading of plural sentences is different from the reading in which a plural NP takes scope over another plural NP. In order to see this, let us first consider how normal QP scope interaction is interpreted. Under the present assumptions, the reading of (28a) in which the subject QP takes scope over the object QP is represented as in (28b):

(28) a. Every woman criticized someone.

b. $[TP \text{ every woman} \lbrack VP t_1 \text{ criticized someone} \rbrack]$

In (28b), the [Scope] feature of *someone* is licensed in situ since it is bound by *every woman*, whose [Scope] feature is licensed by movement, hence both QPs take the same scope domain, namely, the whole TP. Further, the interpretive rules read off from (28b) the reading in which *every woman* takes scope over *someone*, since the former asymmetrically c-commands the latter. According to this reading, each woman criticized a possibly different person. With this in mind, let us consider the following sentences ((29b) is a Japanese translation of (29a)):
To take (29a) for illustration, the reading in which the subject takes scope over the object is represented below:

(30) \[ \text{TP three directors} \text{i}_t \text{p}_t \text{have made five movies}] \]

[Scope] [Scope]

In this representation, the [Scope] feature of *five movies* are licensed by way of being bound by that carried by *three directors*, hence both QPs take the same scope domain, i.e., the whole TP. Further, since the subject QP asymmetrically c-commands the object QP, the former takes scope over the latter. Suppose that plural NPs whose [Scope] features are licensed in situ are interpreted in the same way as those which undergo QR. Then, (30) are interpreted as follows:

(31) \( ( \exists X, X \text{ a set of directors and } |X| = 3)(\exists \Pi_X X)(\forall x \in \Pi_X) [(\exists Y, Y \text{ a set of movies and } |Y| = 5)(\exists \Pi_Y Y)(\forall y \in \Pi_Y) [x \text{ has made } y]] \)

This represents the reading in which each member of a partition of the set of three directors has made possibly different five movies in such a way that that member has made each member of a partition of the set of the five movies, possibly at different times.\(^5\) Note that this reading is different from the cumulative reading of the sentence in question, in which there are just three directors and just five movies involved in the action of making. The latter reading is provided below:

(32) \( ( \exists X, X \text{ a set of directors and } |X| = 3)(\exists \Pi_X X)(\exists Y, Y \text{ a set of movies and } |Y| = 5)(\exists \Pi_Y Y)[(\forall x \in \Pi_X)(\exists y \in \Pi_Y)[x \text{ criticized } y] \land (\forall w \in \Pi_Y)(\exists z \in \Pi_X) [w \text{ was criticized by } z]] \)

This is paraphrased as follows:

(33) There is a partition \( P_1 \) of the set of three directors and a partition \( P_2 \) of the set of five movies such that:

a. Each member of \( P_1 \) has made some member of \( P_2 \); and

b. Each member of \( P_2 \) has been made by some member of \( P_1 \).

Recall that we have seen above that (25a), repeated below as (34), has the cumulative reading, given informally in (27), repeated below as (35).
(34) The women criticized the men.
(35) There is a partition \( P_1 \) of the set of women and a partition \( P_2 \) of the set of men such that:
   a. Each member of \( P_1 \) criticized some member of \( P_2 \); and
   b. Each member of \( P_2 \) was criticized by some member of \( P_1 \).
Under the present assumptions, (34) can have the following LF representation:

(36) \[ TP \text{the women}_i [\wp t_i \text{criticized the men}] \]
      [Scope]                [Scope]
This representation does not represent the cumulative reading of (34), however. This case contrasts with such a case as (30) in that the men cannot be interpreted as under the scope of the women due to the inherent property of definite NPs as presuppositional. Thus, this sentence is interpreted as follows:

(37) There is a partition \( P_1 \) of the set of women and a partition \( P_2 \) of the set of men such that:
   Each member of \( P_1 \) criticized each member of \( P_2 \).
This is an interpretation of what Hintikka (1974) calls branching quantifiers or an independent interpretation according to May (1985). To compare (37) with (35), it is obvious that this reading is different from the cumulative reading.

Now a question arises as to how the cumulative readings of plural sentences should be represented at LF. It has been recently observed (see Winter (1997) and Sauerland (1998), among others) that the availability of the cumulative readings is sensitive to clause-boundedness, as shown below:

(38) a. John and Bill expected Sue and Linda to win.
    b. #John and Bill expected that Sue and Linda would win.
    c. #John and Bill had the expectation that Sue and Linda would win.
(38a) allows the cumulative reading to hold between the sets \( A=\{\text{John, Bill}\} \) and \( B=\{\text{Sue, Linda}\} \); that is, the reading in which both members of Set A have the relation \( \text{expected} \_\_\_ \text{to win} \) with at least one member of Set B and both members of Set B have
that relation borne to it by at least one member of Set A. Thus, this sentence can be
true, for instance, in the situation where John expected Sue to win and Bill expected
Linda to win. (38b) and (38c), by contrast, do not allow the cumulative reading in
question. Similar examples can be provided from Japanese:

(39) a.  John to Bill-ga (sorezore) Sue to Linda-o zibun-no koibito-ni
    and -Nom each and -Acc self -Gen girl friend-Dat
    sitai to itteiru.
    want Comp say
'John and Bill say of Sue and Linda that they want them for their girl friends.'
b. #John to Bill-ga (sorezore) [Sue to Linda-ga zibun-no koibito-ni
    and -Nom each and -Nom self -Gen girl friend-to
    husawasii to] itteiru.
    appropriate Comp say
'John and Bill say that Sue and Linda are appropriate for their girl friends.'

(40) a.  Sannin-no otoko-ga hutari-no onna-o zibun-no koibito-ni
    three -Gen man -Nom two -Gen woman-Acc self -Gen girl friend-Dat
    sitai to itteiru.
    want Comp say
'Three men say of two women that they want them for their girl friends.'
b. #Sannin-no otoko-ga [hutari-no onna-ga zibun-no koibito-ni
    three -Gen man -Nom two -Gen woman-Nom self -Gen girl friend-to
    husawasii to] itteiru.
    appropriate Comp say
'Three man say that two women are appropriate for their girl friends.'

In (39a), Sue to Linda is marked with Accusative Case, so that it is the argument of
the matrix verb itteiru 'say', hence being a clause-mate with the subject John to Bill.
As expected, this sentence allows the cumulative reading, just like (38a). In (39b),
on the other hand, Sue to Linda is marked with Nominative Case, which indicates that
it is the subject of the embedded clause, and it does not give rise to the cumulative reading with the matrix subject *John to Bill*, just like (38b,c). The same observation carries over to the sentences given in (40); while (40a) allows the cumulative reading, (40b) does not allow it. Suppose that the set of the three men consists of John, Bill and Mike and that the set of the two women consists of Mary and Susan. Then, (40a) is true, for instance, in the situation where John and Bill each say of Mary that they want her for their own girl friends and Mike says of Susan that he wants her for his girl friend. (40b), by contrast, cannot be true in the situation where John and Bill each say that Mary is appropriate for their own girl friends and Mike says that Susan is appropriate for his girl friend.

These facts suggest that the availability of the cumulative reading is constrained by a clause-boundedness condition, thus strongly indicating that QR is involved in deriving the appropriate LF representation for this reading. At the same time, this reading should be represented differently at LF from the reading in which one QP takes scope over another. Let us consider the LF representation of (40b) for this latter reading, given below:

\[(41) \quad [\text{TP sannin-no otoko-gai} \quad [\text{vP } t_i \quad [\text{CP } \text{hutari-no onna-gaj} \quad [\text{vP } t_j \quad \text{zibun-no koibito-ni husawasii}] \quad \text{to}] \quad \text{itteiru}]\]

In this representation, the matrix subject QP *sannin-no otoko* 'three men' takes the matrix clause as its scopal domain whereas the embedded subject QP *hutari-no onna* 'two women' takes the embedded clause as its scopal domain, observing the MCL or the clause-boundedness of QR. Since the matrix subject QP asymmetrically c-commands the embedded subject QP, the former takes scope over the latter. Hence, this sentence can mean that three men each say that possibly two different women are appropriate for their own girl friends. If (41) is the only LF representation available to sentence (40b), then we will not be able to account for why the cumulative reading is absent in this sentence. How should, then, this reading be represented at LF? It
is natural to conjecture that this reading differs from the reading in which one QP is
under the scope of another in that the two plural NPs involved in this reading act as
being dependent on each other with equal force rather than one being dependent on
the other. Based upon this intuition, I propose that the appropriate LF representation
for the cumulative reading is derived by means of the operation of absorption, along
the lines of Higginbotham and May's (1981) original ideas. More specifically, I
propose that the cumulative reading of sentence (34), repeated here as (42a), is
represented at LF as in (42b).

(42) a. The women criticized the men.

       [TP [[the womeni] the menj][vP t_i criticized t_j]]

       [Scope] [Scope]

In (42b), the men is adjoined to the women, so that the [Scope] feature of the men is
licensed in this position. I assume, then, that the following interpretive rule applies
to this representation to derive the cumulative reading of (42a):

(43) [TP [[NP_i NP_j][...x_i ... x_j ...]] where NP_i and NP_j are plural NPs

       -> (3Pi[NPi](3Pj[NPj])[(3x_i) ∈ Pi](3y_j) ∈ Pi)[x R y] ∧

       (3w_j ∈ Pi)(3z_i ∈ Pi)[z R w_i]

Given this mechanism of absorption, the clause-boundedness effects with respect to
the availability of the cumulative reading are straightforwardly captured by the MCL
or the clause-boundedness of QR. To take (38b) for illustration, the cumulative
reading of this sentence should be represented as follows:

(44) *[TP [[John and Billj] Sue and Linda_j][vP t_i] expected that [TP t_j [vP t_j would

       [Scope] [Scope]

       win]]]]

In this representation, Sue and Linda is adjoined to John and Bill to satisfy its [Scope]
feature. However, this movement violates the MCL; that is, it skips a possible
landing site for [Scope], namely the embedded TP-adjoined position. Alternatively,
it violates the Last Resort Principle since the [Scope] feature in question is already
satisfied in the embedded Spec-TP. Hence, (44) is an illegitimate LF representation and this explains the unavailability of the cumulative reading for sentence (38b).

The claim that QR is involved in deriving the cumulative readings of plural sentences is further supported by Japanese data involving long distance scrambling of QPs. I have shown in the preceding section that when the surface order reflects the basic word order, as in (45a), it exhibits so-called "rigidity" in scope interaction and further that when a QP undergoes clause-internal scrambling, crossing another QP, as in (45b), either QP can take scope over the other.

(45) a. Sannin-no otoko-ga hutari-no onna-o kinoo tazuneta. (3>2)
   three -Gen man -Nom two -Gen woman-Acc yesterday visited
   'Three men visited two women yesterday.'

b. Hutari-no onna-o i sannin-no otoko-ga t i kinoo tazuneta. (3><2)
   two -Gen woman-Acc three -Gen man -Nom yesterday visited
   Two women, three men visited yesterday.'

When long distance scrambling is involved, interesting facts emerge. Oka (1989) and Tada (1993) observe that long distance scrambling does not change scope order, as illustrated below:

(46) a. Sannin-no otoko-ga [sensee-ga hutari-no onna-ni kisu sita to]
   three -Gen man -Nom teacher-Nom two -Gen woman-Dat kissed Comp
   sinziteiru.
   believe
   'Three men believe that the teacher kissed two women.'

b. Hutari-no onna-ni i sannin-no otoko-ga [sensee-ga t i kisu sita to]
   two -Gen woman-Dat three -Gen man -Nom teacher-Nom kissed Comp
   sinziteiru.
   believe
   'Two women, three men believe that the teacher kissed.'
Although the long distance scrambling of *hutari-no onna-ni* 'two women' crosses *sannin-no otoko* in the matrix subject position, this does not make the sentence ambiguous in the scope order of these two QPs. On the other hand, when a QP undergoes long distance scrambling, crossing another QP in the embedded subject position, this does make the sentence ambiguous, as illustrated below:

(47)  Hutari-no onna-ni i sensee-ga [sannin-no otoko-ga t i kisusita to] two -Gen woman-Dat teacher-Nom three -Gen man -Nom kissed Comp sinziteiru.

believer

'Two women, the teacher believes that three men kissed.'

In Abe (1999a), I argued that these facts are derived by the MCL as cases of clause-boundedness effects of QR. This condition forces sentence (46a) to have the LF representation given below:

(48)  [TP sannin-no otoko-ga i [vP t i [CP[TP hutari-no onna-ni j [TP sensee-ga t j

        [Scope]                     [Scope]

kisusita] to] sinziteiru]]

In this representation, *hutari-no onna-ni* must be adjoined to the embedded TP to satisfy its [Scope] feature, according to the MCL, since if it were adjoined to the matrix TP, it would have skipped a possible landing site, namely the embedded TP-adjoined position, thereby violating the MCL. (48) correctly represents the reading where *sannin-no otoko* takes scope wider than *hutari-no onna*. Similarly, the MCL forces sentence (46b) to have the following representation:

(49)  [TP hutari-no onna-ni i [TP sannin-no otoko-ga j [vP t j [CP[TP t i t]]

        [Scope]                     [Scope]

[kisusita] to] sinziteiru]]

In this representation, *hutari-no onna-ni*, when scrambled long distance, is adjoined to the embedded TP to satisfy its [Scope] in such a way as not to violate the MCL. This then, represents the reading in which *sannin-no otoko* takes scope over *hutari-no*
onna. Therefore, the fact that long distance scrambling does not alter scope order in such cases as (46b) follows from the clause-boundedness of QR, which is in turn derived by the MCL. Let us now consider (47), which can have the following LF representation under the present assumptions:

\[
(50) \quad [\text{TP} \text{ hutari-no onna-ni}] [\text{TP} \text{ sensee-ga} [\text{CP} [\text{TP} \ t_i \ \ t_i \text{ kisusita}]] [\text{TP} \text{ sannin-no otoko-ga}] [\text{CP} [\text{TP} \text{ sensee-ga} \ t_j \text{ kisusita}]]] \text{ to} \text{ sinziteiru}]
\]

In this representation, the [Scope] of hutari-no onna is satisfied in the embedded TP-adjoined position, obeying the MCL. Since it asymmetrically c-commands the [Scope] of sannin-no otoko, (50) represents the reading in which hutari-no onna takes scope over sannin-no otoko, which is in fact available for sentence (47).7

Interestingly, the availability of the cumulative readings of the sentences in (46) and (47) correlates with the availability of the wide scope reading of the long distance scrambled QP hutari-no onna; that is, while the sentences in (46) lack the cumulative readings, sentence (47) allows this reading. These facts are straightforwardly accounted for under the assumption that QR is involved in deriving the cumulative readings. The sentences in (46) should have the following LF representations to derive this reading:

\[
(51) \quad *[\text{TP} [\text{hutari-no onna-ni}] [\text{sannin-no otoko-ga}] [\text{t_i}] [\text{t_i} \text{ kisusita}]] [\text{CP} [\text{TP} \text{ sensee-ga} \ t_j \text{ kisusita}]] [\text{CP} [\text{TP} \text{ sensee-ga} \ t_j \text{ kisusita}]] \text{ to} \text{ sinziteiru}]
\]

\[
(52) \quad *[\text{TP} \text{ hutari-no onna-ni}] [\text{TP} [\text{hutari-no onna-ni}] [\text{sannin-no otoko-ga}] [\text{t_j}] [\text{t_j} \text{ kisusita}]] [\text{CP} [\text{TP} \text{ sensee-ga} \ t_j \text{ kisusita}]] [\text{CP} [\text{TP} \text{ sensee-ga} \ t_j \text{ kisusita}]] \text{ to} \text{ sinziteiru}]
\]

In (51), hutari-no onna-ni is adjoined to sannin-no otoko-ga at LF to satisfy its [Scope] feature, but this movement violates the MCL, since the [Scope] feature could have been satisfied in the embedded TP-adjoined position. Likewise, in (52), hutari-no onna-ni is adjoined to sannin-no otoko-ga on the way of adjoining to the matrix.
TP-adjoined position by scrambling, thereby satisfying its [Scope] feature. This movement, however, violates the MCL for exactly the same reason as in (51). Hence, we can correctly account for the unavailability of the cumulative readings for the sentences in (46). Let us now consider the LF representation of sentence (47) that represents the cumulative reading, given below:

(53)  $\left[ \text{TP } \text{hutari-no onna-ni } \left[ \text{TP } \text{sensee-ga} \left[ \text{CP } \left[ \text{TP } \left[ \left[ \text{sannin-no otoko-ga} \right] \left[ \left[ t_i \right] \right] \right] \right] \right] \right] \right]$ \\
      $\text{[Scope]} \text{[Scope]}$ \\
      $\left[ \text{vP } \left[ t_i t_i \text{kisusita} \right] \text{to} \left[ \text{sinziteiru} \right] \right]$ \\

In this representation, hutari-no onna-ni is adjoined to sannin-no otoko-ga in the embedded subject position on the way of long distance scrambling to the matrix clause, thereby satisfying its [Scope] feature. This movement observes the MCL, since the [Scope] feature in question is satisfied in the most local domain for scope. Hence, this correctly accounts for the fact that the cumulative reading is available for sentence (47).

3.1. Rigidity

Let us now examine whether the availability of the cumulative readings is sensitive to rigidity effects observed in Japanese data such as (8), (9) and (45). The relevant condition that derives these effects is repeated below:

(54)  Crossing Constraint on QR (CCQR)

A feature [Scope]$_i$ cannot cross another feature [Scope]$_j$, unless it is carried along as a free ride.

Let us first consider the following Japanese sentence:


\begin{itemize}
  \item that children \-Nom that street artists \-Dat coin \-Acc one gave
\end{itemize}

'Those children gave a coin to those street artists.'

This sentence allows the cumulative reading to hold between the SUB sono kodomo-tati 'those children' and the IO sono daidoo-geenin-tati 'those street artists'. Further,
the DO *ginka-o itimai 'a coin' can be under the scope of these NPs, so that its value can be different in each relation borne by the members of the sets denoted by these two NPs under the cumulative reading. Under the present assumptions, this reading is represented as follows:

(56) \[TP[[sono kodomo-tati-ga_i] [sono daidoo-geenin-tati-ni_j]] [vP t_i t_j [ginka-o

\[Scope\] \[Scope\] \[Scope\]

itimai ageta]]\]

In this representation, the IO *sono daidoo-geenin-tati-ni* is adjoined to the SUB *sono kodomo-tati* at LF to satisfy its [Scope] feature, and this movement does not violate the CCQR, since it does not cross any element carrying [Scope]. The [Scope] feature of the DO *ginka-o itimai* is satisfied by means of being bound by the NPs having undergone absorption operation, and hence this indefinite NP is interpreted as under their scope. According to (43), then, the whole representation is interpreted as follows:

(57) \(\exists \Pi_i \text{ the children}_i)(\exists \Pi_j \text{ the street artists}_j)(\forall x \in \Pi_i)(\exists y \in \Pi_j)(\exists z, z \text{ a coin})[x \text{ gave } z \text{ to } y] \land (\forall u \in \Pi_i)(\exists v \in \Pi_j)(\exists w, w \text{ a coin})[u \text{ gave } w \text{ to } v]\]

Now let us compare sentence (56) with the following sentence:

(58) *Sono onnanoko-tati-ga dareka sensee-ni sorera-no tabemono-o ageta.*

'those girls' and *sorera-no tabemono* 'those foods', but that is possible with the proviso that *dareka sensee* 'some teacher' must be a specific teacher. We can offer a natural account for this fact by assuming, following Abe (1993a), that an existential indefinite is a real QP, hence carrying [Scope], while a specific indefinite is more like a referential NP, hence not carrying [Scope]. Let us take *dareka sensee* as a real QP, hence carrying [Scope]. Then, the cumulative reading of (58) should be represented as follows:
In this representation, the DO *sorera-no tabemono-o* is adjoined to the SUB *sono onnanoko-tati-ga* at LF to satisfy its [Scope] feature, and this movement violates the CCQR, since it crosses the IO *dareka sensee-ni*, which carries its own [Scope]. Hence the only legitimate LF representation for the cumulative reading of (58) is the one in which *dareka-sensee-ni* does not carry a [Scope] feature. This guarantees the fact that (58) can have the cumulative reading only when *dareka sensee* is interpreted as a specific teacher. The contrast between (56) and (58) with respect to the availability of the cumulative reading thus indicates that rigidity effects on QR are operative in deriving this reading.9

Let us next consider the cases corresponding to (56) and (58) where the DO is preposed before the IO by scrambling; (60) and (61) correspond to (56) and (58), respectively.


'Those children gave a coin to those street artists.'

(61) Sono onnanoko-tati-ga sorera-no tabemono-o_i (sorezore)

that girls -Nom those -Gen food -Acc each

[dareka sensee]-ni ti ageta.

'Those girls gave some teacher those foods.'

Both sentences allow the cumulative readings in question and further both the indefinite NPs *ginka-o itimai* 'a coin' in (60) and *dareka sensee-ni* 'some teacher' in (61) can be interpreted as existential, so that their values may differ according to the ordered set of values of the two NPs having undergone absorption operation. These facts follow straightforwardly under the present assumptions. Recall that we have
been assuming that a scrambled QP can carry its [Scope] feature with it or it can leave it behind (cf. (15) vs. (16)). (60) can, then, have the following LF representation:

(62) \[\text{TP} \left[ \left[ \text{sono kodomo-tati-ga} \right]_i \left[ \text{sono daidoo-geenin-tati-ni} \right]_j \right] \left[ _v \left[ _p t_i \left[ \text{[Scope]} \right] \left[ \text{[Scope]} \right] \right] \left[ \text{ginka-o itimai} \right]_k t_j t_k \text{ ageta] \right] \right] \left[ \text{[Scope]} \right]

In this representation, the [Scope] feature of the DO \text{ginka-o itimai} is left behind when the DO undergoes scrambling. This makes it possible for the IO \text{sono daidoo-geenin-tati-ni} to move from the position marked as \( t_j \) and adjoin to the SUB \text{sono kodomo-tati-ga} without violating the CCQR. (62) correctly represents the interpretation in which the SUB and the IO induce the cumulative reading and the DO is under the scope of these two NPs. Let us now consider the LF representation of (61) that represents the relevant interpretation:

(63) \[\text{TP} \left[ \left[ \text{sono onnanoko-tati-ga} \right]_i \left[ \text{sorera-no tabemono-o} \right]_j \right] \left[ _v \left[ _p t_i t'_j \text{ dareka} \left[ \text{[Scope]} \right] \left[ \text{[Scope]} \right] \left[ \text{[Scope]} \right] \right] \right] \left[ \text{sensee-ni} t_j \text{ ageta] \right] \right]

In this representation, the DO \text{sorera-no tabemono-o} is moved at LF from the position \( t'_j \), to which it is scrambled and is adjoined to the SUB \text{sono onnanoko-tati-ga} to satisfy its [Scope] feature. Thanks to the scrambling of the DO that crosses the IO \text{dareka sensee-ni}, the LF adjunction does not violate the CCQR; note that the scrambling itself does not violate this condition, either, since the [Scope] feature is carried along as a free ride in this case. Thus, (63) correctly represents the interpretation in which the SUB and the DO give rise to the cumulative reading and the IO indefinite is interpreted as under the scope of these two NPs.

Further Japanese examples can be provided with different patterns. Let us consider the following examples:
(64) a. Sorera-no tabemono-o i dareka onnanoko-ga sono otosiyori-tati-nij ti
those -Gen food -Acc some girl -Nom that old people -Dat
ageta.
gave
'Those foods, some girl gave to those old people.'
b. Sono otosiyori-tati-nij dareka onnanoko-ga ti sorera-no tabemono-o i
that old people-Dat some girl -Nom those-Gen food -Acc
ageta.
gave
'To those old people, some girl gave those foods.'

(64a) does not allow the cumulative reading to hold between the scrambled DO
sorera-no tabemono-o 'those foods' and the IO sono otosiyori-tati-ni 'those old people'
unless the intervening SUB dareka onnanoko-ga 'some girl' is taken as a specific girl.
The same holds true for (64b); the cumulative reading between the scrambled IO and
the DO is possible only when the intervening SUB is taken as a specific girl.
Suppose that these intervening indefinite NPs are real QPs, carrying [Scope] features.
Then, (64a) and (64b) have the following representations before the absorption
operation takes place between the plural NPs in question:
(65) a. [sorera-no tabemono]-o i [dareka onnanoko]-ga [sono otosiyori-tati]-nij ti

[Scope] [Scope] [Scope]
ageta.

b. [sono otosiyori-tati]-nij [dareka onnanoko]-ga ti [sorera-no tabemono]-o i

[Scope] [Scope] [Scope]
ageta.

From these stages of derivations, the IO sono otosiyori-tati-ni in (65a) and the DO
sorera-no tabemono-o in (65b) cannot adjoin to the scrambled NPs to satisfy their
[Scope] features without violating the CCQR. In order for this adjunction to be
possible, the intervening SUBs must lack [Scope] features. This explains why the
cumulative readings in question are possible in (64a,b) only when the intervening indefinite SUBs are interpreted as specific. Now let us consider the sentences corresponding to those in (64) in which both DOs and IOs are scrambled before SUBs, as shown below:

(66) a. Sorera-no tabemono-o i sono otosiyori-tati-ni j dareka onnanoko-ga t_j t_i 
   those -Gen food -Acc that old people -Dat some girl -Nom 
   gave
   'Those foods, to those old people, some girl gave.'

b. Sono otosiyori-tati-ni j sorera-no tabemono-o i dareka onnanoko-ga t_j t_i 
   that old people -Dat those -Gen food -Acc some girl -Nom 
   gave
   'To those old people, those foods, some girl gave.'

Unlike the sentences in (64), these sentences allow the cumulative readings to hold between the IOs and the DOs, and the indefinite SUBs can be interpreted as existential, their semantic values possibly varying according to those of the paired sets of the two plural NPs under absorption. These facts follow immediately under the present assumptions. Let us consider the representations of these sentences in which absorption operation has not taken place yet:

(67) a. [sorera-no tabemono]-o_i [sono otosiyori-tati]-nij [dareka onnanoko]-ga t_j t_i 
   [Scope] [Scope] [Scope] 
   ageta.

b. [Sono otosiyori-tati]-nij [sorera-no tabemono]-o_i [dareka onnanoko]-ga t_j t_i 
   [Scope] [Scope] [Scope] 
   ageta.

From these stages of derivations, the IO sono otosiyori-tati-ni in (67a) and the DO sorera-no tabemono-o in (67b) can be adjoined at LF to the other objects preceding
them to undergo absorption operation, since no elements carrying [Scope] features intervene in these movements. These operations are possible irrespective of whether the SUBs carry [Scope] features. This explains why the SUB indefinites are not forced to be specific when the two objects under absorption give rise to the cumulative readings.

To summarize, I have shown that QR, i.e., movement for satisfying [Scope], is involved in deriving the cumulative readings of plural sentences, by using mainly Japanese data that exhibit clause-boundedness effects and rigidity effects, which are typical restrictions on QR.

4. Reciprocity

In this section, I will argue that QR is involved in deriving appropriate interpretations of reciprocal sentences. More specifically, I will give support to an approach of the sort taken by Heim, Lasnik and May (1991) (henceforth, HLM), in which each-movement is posited. I will argue that such movement is a special case of QR, showing that it is sensitive to rigidity effects. Such an analysis of reciprocals receives its initial support from semantic considerations, since it is rather natural to consider a reciprocal sentence such as (68) to have a semantic structure similar to that derived from a sentence such as (69).

(68) Those men were criticizing each other.

(69) Each of those men was criticizing the other(s).

Based on this consideration, HLM propose that a sentence such as (68) has the following LF representation after each-movement takes place:

\[
[TP [NP [NP those men] each] were [iP t \text{ criticizing } [NP e other]k]]
\]

In this representation, \([those men each]\) functions as the distributor-part in which each introduces a universal quantification over those men, and \([e other]\) functions as the reciprocator part in which other requires assigning a value distinct from that assigned by each. Given that both the distributor and reciprocator parts function as
universal quantifiers, HLM assume that they undergo QR. Thus, (70) is mapped onto the following LF representation after QR applies:

(71)  \[ TP \[ NP[NP those\ men]_i \ each]_j [TP \ t'_j \ were \ [vP \ [NP \ other]_k \ [vP \ t_j \ criticizing \ t_k]]] \]

Let us consider the derivations in (70) and (71) more closely in our terms regarding QR. The reason why \textit{each} is attached to \textit{those men} is to identify an NP that can supply \textit{each} with a domain over which it applies a universal quantification. The \textit{each} of \textit{each other} can thus be characterized as a universal quantifier lacking its domain. Since it is a quantifier, it is natural to assume that it carries the feature \texttt{[Scope]}. Given this, it needs to undergo QR to move to a position where it can take scope. This quantifier differs, however, from other normal quantifiers in that it lacks its domain, so it needs to adjoin to an NP before it moves to a position where it takes scope. In other words, this quantifier needs two steps of movement, one for finding an NP to which it applies a universal quantification, as shown in (70), and the other for taking scope, as shown in (71).

I will modify HLM's analysis of reciprocals in such a way that it is not \textit{each} but \textit{each other} as a whole that undergoes the first step of movement. It is not obvious in HLM's analysis why the distributor-part and the reciprocator-part must undergo QR independently. It is more plausible from syntactic points of view to apply QR to the whole NP \textit{each other} rather than to apply it separately, so that the distributor-part and the reciprocator-part never break up. For these reasons, I assume the following:

(72)  \textit{Each other} is a binary quantifier carrying the feature \texttt{[Scope]}.

Given this, sentence (68) has the following LF representation:

(73)  \[ TP \[ NP[NP those\ men]_i \ [each\ other]]_j,k \ were \ [vP \ t_j \ criticizing \ t_k]] \]

Here \textit{each other} is adjoined to \textit{those men} in Spec-TP to identify its domain, and its \texttt{[Scope]} feature is automatically licensed in this position. The two indices assigned
to *each other* indicate that the reciprocal is a binary quantifier which binds two arguments, the subject \( t_j \) and the object \( t_k \) in (73). Let us consider a case where the antecedent of *each other* is a non-subject, such as the following:

(74) John introduced the guests to each other.

Under the present assumptions, this sentence involves two steps of movement of *each other*, as shown below:

(75) a. \([TP \text{John}_i [\text{v}_P \text{t}_i \text{introduced} [\text{NP[NP the guests]}_j [\text{each other}]]_{k,l} \text{to} t_l]]\)  
    [Scope]

b. \([TP [\text{NP[NP the guests]}_j [\text{each other}]]_{k,l} [TP \text{John}_i [\text{v}_P \text{t}_i \text{introduced} t_k \text{to} t_l]]\)  
    [Scope]

In (75a), *each other* is adjoined to the guests to identify its domain, and then the whole NP is adjoined to TP to license the [Scope] feature, as shown in (75b).

We need to consider now how such LF representations as (73) and (75b) are interpreted. HLM assume (76) and (77) as the semantic translations of *each* and *other*, respectively, which apply to the LF representation given in (71).

(76) \([\alpha \text{each}_i] \psi \rightarrow \forall x_i(\alpha \cdot \Pi \alpha')\psi'\)

where \( \cdot \Pi \) is the proper-atomic-part-of relation

(77) \([\epsilon_i \text{other}_j] \zeta \rightarrow \lambda y \forall x_j(\chi_j \cdot \Pi \chi_k \wedge x_i \neq x_j)\zeta(y)\)

where \( x_k \) represents the domain of *other*

Under the assumption that the domain of *other* is fixed as the set denoted by the antecedent of *each*, (76) and (77) assign (71) the following interpretation: every member of those men was criticizing every other member of those men. Hence, according to HLM’s semantics (76) and (77), the interpretation assigned to (71) is just the interpretation that (69) has. However, that the semantics given in (76) and (77) is too strong is shown by the observation made by Langendoen (1978) and Gillon (1984) that reciprocal sentences can be true in situations in which the members that bear reciprocal relations are not atomic. Consider the following example:

(78) Her grandparents hate each other.
Gillon (1984) observes that "this sentence may be true even if the reciprocal hatred is only between the maternal grandparents on the one hand and the paternal ones on the other." He further notes that such an interpretation is forced when both is attached to the antecedent of each other in a sentence such as the following:

(79) The men and the women both admire each other.

This sentence means that the set of the men is in a reciprocal relation with the set of the women.

In order to accommodate this reading, we can change the semantics of each and other in such a way that the atomic partition represented by •\( \Pi \) in (76) and (77) is weakened so as to allow a non-atomic partition. The fact that the each of each other allows a non-atomic distribution is reminiscent of the interpretation of plural NPs in general. Recall that we assumed in the preceding section that plurals NPs that undergo QR are interpreted according to (20), repeated below:

(80) \[ \text{TP N}_i \{ \ldots x_i \ldots \} \text{ where N}_i \text{ is a plural NP} \]

\[
\rightarrow (\exists \Pi N_i)(\forall x \in \Pi)[ \ldots x \ldots ]
\]

Reciprocals can be described as a special case of the semantic relations between two plural NPs in which the sets of the two plural NPs are the same and, given each member \( m_i, m_j, \ldots \) of a partition of that set, \( m_i \neq m_j \) in \( m_i R m_j \). Thus, the semantics of each other can be given as in (81).

(81) \[ [\alpha \text{ each other]}_{i,j}] \psi \rightarrow (\exists \Pi \alpha')(\forall x_i\forall x_j(x_i, x_j \in \Pi \land x_i \neq x_j))\psi'
\]

where \( \Pi \) is a partition defined in (21).

Given this semantics, (68) is interpreted as follows: there is a partition \( \Pi \) of the set denoted by those men such that every member of \( \Pi \) was criticizing every other member of \( \Pi \). Thus, this sentence can be true, for instance, in the situation where those men are divided into some groups and each group was criticizing the other groups. This sentence happens to have the same meaning as (69) when \( \Pi \) functions as a proper atomic partition.
What I have so far said about the meaning of English reciprocals hold true for Japanese reciprocals. The Japanese counterpart of sentence (68) is provided below:

(82) Sono otoko-tati-ga otagai-o hihansite-ita.

that men -Nom each other-Acc criticizing-were

'Those men were criticizing each other.'

Let us suppose, following Abe (1993b), that the Japanese reciprocal otagai has the following internal structure:

(83) [NP D otagai]

where D serves as a covert distributor and otagai serves as a reciprocator. Sentence (82), then, has the following LF representation under the present assumptions:

(84) [TP [NP[NP sono otoko-tati]-gai [NP D otagai]-o]j,k [vP t_j t_k hihansite-ita]]

[Scope]

Here [D otagai] is adjoined to the SUB sono otoko-tati to identify its domain and its [Scope] feature is satisfied in this position. Given the assumption that [D otagai] is interpreted in the same way as each other, according to (81), (82) is given the following interpretation: there is a partition Π of those men such that every member of Π was criticizing every other member of Π.

We are now ready to examine whether reciprocals exhibit rigidity effects, which will be expected under the present analysis of reciprocals. Since such effects are clearly attested in Japanese, I will use Japanese reciprocal sentences to examine these effects. Let us first consider the following Japanese examples:

(85) a. Sono otoko-tati-ga otagai-ni dareka onnanoko-o syookai-sita.

that men -Nom each other-Dat some girl -Acc introduced

'Those men introduced some girl to each other.'

b. Sono otoko-tati-ga dareka onnanoko-ni otagai-o syookai-sita.

that men -Nom some girl -Dat each other-Acc introduced

'Those men introduced each other to some girl.'
In (85a), *dareka onnanoko* 'some girl' can be taken as existential, so that a girl who was introduced may be different in each action of mutual introduction among those men. In (85b), by contrast, *dareka onnanoko* must be a specific girl. These facts follow straightforwardly under the assumption that QR is involved in deriving the appropriate LF representations of the reciprocal sentences in (85) and it is sensitive to the CCQR, repeated below:

*(86)*  **Crossing Constraint on QR (CCQR)**

A feature [Scope] i cannot cross another feature [Scope] j, unless it is carried along as a free ride.

Under the present assumptions, the sentences in (85) have the following LF representations:

*(87)*

a.  \[ TP \left[[\text{sono otoko-tati}-\text{ga}]_{ij,k}\left[vP\, t_j, t_k\, [\text{dareka onnanoko}]-o\right.\right.\]

                  \[\text{[Scope]}\quad \text{[Scope]}\]

\[\text{syookai-sita}]\]

b.  \[^*\left[TP\left[[\text{sono otoko-tati}-\text{ga}]_{ij,k}\left[vP\, t_j\, [\text{dareka onnanoko}]-ni\, t_k\right.\right.\right.\]

                  \[\text{[Scope]}\quad \text{[Scope]}\]

\[\text{syookai-sita}]\]

In (87a), *D otagai*-ni is adjoined at LF from the position marked as \(t_k\) to the SUB *sono otoko-tati-ga* to identify its domain and its [Scope] feature is licensed in this position. This adjunction operation does not violate the CCQR, since no element carrying [Scope] does not intervene in this movement. Nothing, then, prevents *dareka onnanoko* from carrying [Scope] and hence this indefinite NP can be taken as an existential quantifier which is under the scope of the SUB plural NP. In (87b), on the other hand, the adjunction of *D otagai*-o to the SUB NP violates the CCQR, since it crosses *dareka onnanoko*, which carries [Scope]. Hence, the only legitimate LF representation available for (85b) is the one in which *dareka onnanoko* does not carry [Scope]. This correctly accounts for the fact that the indefinite NP is forced to
be interpreted as specific in (85b). Let us next consider the sentences corresponding to those in (85) in which the DOs are scrambled before the IOs, as shown below:

(88) a. Sono otoko-tati-ga dareka onnanoko-o i otagai-ni t syookai-sita.
    that men -Nom some girl -Acc each other-Dat introduced
    'Those men introduced some girl to each other.'

b. Sono otoko-tati-ga otagai-o dareka onnanoko-ni t syookai-sita.
    that men -Nom each other-Acc some girl -Dat introduced
    'Those men introduced each other to some girl.'

Both sentences allow the indefinite NP *dareka onnanoko* to be taken as an existential quantifier which is under the scope of the SUB plural NP. Under the present assumptions, the sentences in (88) can have the following LF representations:

(89) a. \[
    [TP \[\langle sono otoko-tati\rangle\text{-ga} \[D otagai\]-ni]_{\text{i},j,k} \[vP t_j [\langle dareka onnanoko\rangle\text{-o}]_l t_k t_l}
        \text{[Scope]} \quad \text{[Scope]}
    syookai-sita]]
\]

b. \[
    [TP \[\langle sono otoko-tati\rangle\text{-ga} \[D otagai\]-o]_{\text{i},j,k} \[vP t_j t'_k [\langle dareka onnanoko\rangle\text{-ni}]_k t_k}
        \text{[Scope]} \quad \text{[Scope]}
    syookai-sita]]
\]

In (89a), when the DO *dareka onnanoko-o* is scrambled before the IO, its [Scope] feature is left behind. This enables the IO *\[D otagai\]-ni* to adjoin to the SUB without violating the CCQR. (89a) correctly represents the reading in which the indefinite DO is under the scope of the SUB plural NP. In (89b), when the DO *\[D otagai\]-o* is scrambled before the IO, its [Scope] feature is carried along with this movement. The adjunction of the reciprocal from the scrambled position to the SUB does not violate the CCQR and hence (89b) correctly represents the reading in which the indefinite IO is under the scope of the SUB plural NP.

The same point can be made with more Japanese examples of different patterns. Let us first consider the following sentences:
(90) a.  Sono onnanoko-tati-ni dareka otokonoko-ga  $t_i$  otagai-o  syookai-sita.
    that  girls       -Dat some  boy    -Nom each other-Acc introduced
    'To those girls, some boy introduced each other.'

b.  Sono onnanoko-tati-o  dareka otokonoko-ga otagai-ni  $t_i$  syookai-sita.
    that  girls       -Acc some  boy    -Nom each other-Dat introduced
    'Those girls, some boy introduced to each other.'

In both sentences, the indefinite NP SUB *dareka otokonoko* 'some boy' must be taken
as a specific boy.  To see why, let us consider their LF representations, given below:

(91) a. *$[\text{TP} \left[ \left[ \text{sono onnanoko-tati} \right]-n_{i} \left[ D \text{ otagai} \right] -o \right]_{j,k} \left[ \text{TP} \left[ \text{dareka otokonoko} \right]-g_{a} \right]_{i,p} t_{l}\right]$

    $[\text{Scope}]$    $[\text{Scope}]$


b. *$[\text{TP} \left[ \left[ \text{sono onnanoko-tati} \right]-o_{i} \left[ D \text{ otagai} \right] -n_{i} \right]_{j,k} \left[ \text{TP} \left[ \text{dareka otokonoko} \right]-g_{a} \right]_{i,p} t_{l}\right]$  

    $[\text{Scope}]$    $[\text{Scope}]$

In both representations, the adjunction of the reciprocals to the scrambled objects
violates the CCQR, since it crosses the SUB *dareka otokonoko*, which carries [Scope].

In order to obtain the legitimate LF representations for the sentences in (90), we need
to select indefinite SUBs which do not have [Scope] features.  This forces the
indefinite NP SUBs in these sentences to be interpreted as specific boys.  Let us next
consider the sentences corresponding to those in (90) in which both IOs and DOs are
scrambled before SUBs, as shown below:

(92) a.  Sono onnanoko-tati-ni otagai-o  $t_i$  $t_j$  syookai-sita.
    that  girls       -Dat each other-Acc some  boy    -Nom introduced
    'To those girls, each other, some boy introduced.'

b.  Sono onnanoko-tati-o  otagai-ni  $t_i$  $t_j$  syookai-sita.
    that  girls       -Acc each other-Dat some  boy    -Nom introduced
    'Those girls, to each other, some boy introduced.'

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Unlike the sentences in (90), these sentences allow the readings in which the indefinite NP SUBs are interpreted as existential quantifiers, being under the scope of the plural NP objects. This fact follows straightforwardly under the present assumptions. The above sentences have the following surface structures:

(93) a.  \[ TP [sono onnanoko-tati]-ni [TP [D otagai]-o]_j [TP [dareka otokonoko]-gak [Scope] [Scope] [vP t_k t_i t_j syookai-sita]]]  

b.  \[ TP [[sono onnanoko-tati]-o]_i [TP [D otagai]-ni]_j [TP [dareka otokonoko]-gak [Scope] [Scope] [vP t_k t_j t_i syookai-sita]]]  

From these surface structures, the reciprocals need to be adjoined to the plural NP objects scrambled initially to identify their domains and these adjunction operations do not violate the CCQR. Hence, nothing prevents the indefinite SUBs from carrying [Scope] features and they are interpreted as existential quantifiers under the scope of the plural NP objects.


We have shown above that rigidity effects are observed in Japanese reciprocal sentences, hence strongly indicating that QR is involved in deriving the appropriate LF representations of reciprocal sentences. In this section, I provide further evidence for QR in considering those reciprocal sentences that allow the cumulative readings. Sternefeld (1993) points out a problem for such an analysis as HLM's in which the each of each other is treated on a par with each of and the floating each, so that a reciprocal sentence such as (68), repeated below as (94) is in a paraphrase relation with such a sentence as (69), repeated below as (95).

(94)  Those men were criticizing each other.  
(95)  Each of those men was criticizing the other(s).
Sternefeld observes that the following sentences do not necessarily have the same meaning:

(96) a. They wrote these six letters to each other.
   b. They each wrote these six letters to (each of) the other(s).

While (96a) allows the cumulative reading to hold between the plural NPs *they* and *these six letters*, (96b) does not allow such a cumulative reading. Suppose that *they* consists of John, Bill and Tom. Then, (96a) can be true in the situation where John wrote two of these letters to Bill and Tom, Bill wrote another two of them to John and Tom, and Tom wrote the remaining two letters to John and Bill. (96b), in contrast, cannot be true in this situation. In this respect, *each of* and the floating *each* behave like a genuine universal quantifier such as *every __*. Let us consider the following example:

(97) Every woman criticized the men.

This sentence does not allow the cumulative reading and only has what May (1985) calls the independent interpretation; that is, in a partition P of the set of men, each woman criticized each member of P (possibly at different times). The same is true of *each of* and the floating *each*:

(98) a. Each of the women criticized the men.
   b. The women each criticized the men.

Both sentences only allow the independent interpretation. This may be attributed to the lexical meaning of *each* which partitions the set of the NP it attaches to into atomic members, as given in HLM's semantic translation (76), repeated below:

(99) \[ \alpha \text{ each}_i ] \varphi \rightarrow \forall x_i (x_i \cdot \Pi \alpha') \varphi' \]

where \( \cdot \Pi \) is the proper-atomic-part-of relation

These facts indicate that some kind of "plurality" is required for the cumulative reading to be possible. Recall that this reading allows non-atomic partition of the sets involved, so that the members involved in the action described by a predicate can be a group, as indicated in the semantic translation (43), repeated below:
(100) \[ \text{TP} \left[ [\text{NP}_i \text{ NP}_j] \left[ \ldots x_i \ldots x_j \ldots \right] \right] \text{ where NP}_i \text{ and NP}_j \text{ are plural NPs} \]
\[ \rightarrow (\exists \Pi_i \text{ NP}_i)(\exists \Pi_j \text{ NP}_j)[(\forall x \in \Pi_i)(\exists y \in \Pi_j)[x \in R y] \land \(\forall w \in \Pi_j)(\exists z \in \Pi_i)[z \in R w]] \]

From this consideration, we can make the following generalization:

(101) The cumulative reading between NP_i and NP_j is possible only if NP_i and NP_j allow non-atomic partition.

Suppose that this statement is true, leaving aside the question why this is true. Then, the fact that reciprocal sentences such as (96a) can have the cumulative reading follows immediately from our observation made above that each other does not require atomic partition to its antecedent, as indicated in the semantic translation (81), repeated below:

(102) \[ [\alpha \text{ each other}_{i,j}]_{\psi} \rightarrow (\exists \Pi \alpha')(\forall x_i \forall x_j(x_i \in \Pi \land x_i \neq x_j))\psi' \]

where \( \Pi \) is a partition defined in (21).

Now I propose that the reciprocal sentence (96a) has the following LF representation:

(103) \[ \text{TP} \left[ \text{NP[NP they]}_i \text{ each other}_{j,k} \text{ these six letters}_l \right] \left[ \text{vP} t_j \text{ wrote } t_l \text{ to } t_k \right] \]

In this representation, each other is adjoined to they at LF to identify its domain and these six letters is adjoined to this newly-created NP to undergo absorption operation. From the semantic translations (100) and (102), (103) will be interpreted as follows:

(104) \[ (\exists \Pi_i \text{ they})(\exists \Pi_l \text{ these six letters})[\forall x_i \forall x_j(x_i \in \Pi_i \land x_i \neq x_j)\exists y (y \in \Pi_l)[x_i \text{ wrote } y \text{ to } x_j] \land \forall w (w \in \Pi_l)\exists z_j (z_i, z_j \in \Pi_l \land z_i \neq z_j)[z_i \text{ wrote } w \text{ to } z_j] \]

Suppose that they consists of John, Bill and Tom and that this set is partitioned into atomic members: \{John\}, \{Bill\}, and \{Tom\}. Suppose further that these six letters are partitioned into the following three members: \{L_1, L_2\}, \{L_3, L_4\}, \{L_5, L_6\}. Then, the former part of (104) requires that every member of the set of they must have a reciprocal relation to every other member of the set and further that each reciprocal
relation involves at least one member of the set of \textit{these six letters}. Thus, the following situation satisfies these truth conditions:

(105) a. John wrote \(L_1\) and \(L_2\) to Bill and Tom.

b. Bill wrote \(L_3\) and \(L_4\) to John and Tom.

c. Tom wrote \(L_5\) and \(L_6\) to John and Bill.

The latter part of (104) requires that each member of the set of these six letters must be involved in at least one reciprocal relation, and the situation described in (105) satisfies this truth condition. Hence, given the LF representation (103) and the semantic translations (100) and (102), we can correctly account for the fact that such a reciprocal sentence as (96a) can have the cumulative reading.

What has been claimed about the availability of the cumulative readings for English reciprocal sentences also carries over to Japanese reciprocal sentences: Let us consider the following examples:

(106) a. Karera-wa (korera) rokutuu-no tegami-o otagai-ni kaki-okutta.

\begin{center}
\text{they Top these six Gen letter Acc each other Dat write-sent}
\end{center}

'They wrote and sent (these) six letters to each other.'

b. Karera sorezore-ga (korera) rokutuu-no tegami-o otagai-ni

\begin{center}
\text{they each Nom these six Gen letter Acc the other Dat write-sent}
\end{center}

'They each wrote and sent (these) six letters to the others.'

(106a) is an approximate Japanese counterpart of (96a) and it allows the cumulative reading. Hence, this sentence can be true in the situation described in (105). (106b) is an approximate Japanese counterpart of (96b) and it only has the independent reading, according to which in a partition \(P\) of the set of these six letters, each of them wrote and sent each member of \(P\) to the others (possibly at different times). These facts follow immediately under the present assumptions. In (106b), \textit{sorezore 'each'} is attached to the subject \textit{karera 'they'} and it partitions the set of \textit{karera}
into atomic members. Hence, the subject cannot participate in creating the cumulative reading according to generalization (101). (106a), on the other hand, can have the following LF representation:

(107) \[ TP [NP[NP karera]-wai [D otagai]-ni]j,k [(korera) rokutuu-no tegami]-ol] \]

This representation is interpreted exactly as in (103), given the semantic translations (100) and (102), and hence correctly represents the cumulative reading of (106a).

I have so far shown how Sternefeld's (1993) problem can be approached under my analysis of reciprocals and the cumulative reading. I will now show that further examinations of available interpretations of Japanese reciprocal sentences reveal that there is an interesting restriction on the availability of the cumulative reading and one of the interpretations found in Japanese reciprocal sentences. I will argue that the lack of one reading of reciprocal sentences when they are taken to have the cumulative reading as well is attributed to rigidity effects, hence constituting evidence for my claim that QR is involved in deriving reciprocity and the cumulative reading.

The reading in question that is available to Japanese reciprocals is what I called the partition reading in Abe (1999b). That this reading is available to English reciprocals is already observed by Fiengo and Lasnik (1973). They claim that (108) can be true in the situation described in (109).

(108) Those men were hitting each other.
(109) The set denoted by those men is divided into subsets S_i such that every member of S_i was hitting every other member of S_i.

The reason why this reading is called the partition reading is that Fiengo and Lasnik (1973) claim that the division involved in (109) is a partition, and hence that the subsets S_i are pairwise disjoint. Though this is a controversial claim at least for English reciprocals, let us assume that it is the case.12 Nishigauchi (1992) observes
that Japanese reciprocal sentences allow the partition reading when the reciprocal
affix \(-aw\) is added to the predicates. Let us consider the following examples:

(110) (Baa-de) otoko-tati-ga otagai-o nagutte-iru.

\[\text{bar -in men -Nom each other-Acc be-hitting}\]

'Men are hitting each other (in the bar).'</n

(111) (Baa-de) otoko-tati-ga (otagai-o) naguri-aw-te-iru.

\[\text{bar -in men -Nom each other-Acc hitting-Recip-be}\]

'Men are hitting each other.'</n

Nishigauchi observes that while (110) lacks the partition reading, (111) without the
object \(otagai-o\) has this reading, and obviously (111) with \(otagai-o\) also has this
reading. Thus, (111) can be true in a situation in which the mutual hitting relation
only holds in each subdivided group of the men in question. I refer the reader to Abe
(1999b) for the question of why the partition reading is available for Japanese
reciprocal sentences only when the reciprocal affix \(-aw\) is added to the predicates, and
move on to the question of how this reading is represented at LF. In Abe (1999b), I
argued that the partition reading is derived from an LF representation in which the
\(each of each other\) is attached to the trace of its antecedent rather than being directly
attached to its antecedent. Modifying this approach so as to make it compatible with
the present assumption that it is \(each other\) as a whole rather than \(each\) that is attached
to its antecedent, sentence (108) will have the following LF representation:

(112) \[\text{[TP [NP those men]}i\text{ were [vP [NP}\text{ ti\text{ [each other}]}j,k\text{ hitting }t_k]\text{]}\]

\[\text{[Scope] [Scope]}\]

In this representation, \(those men\) has its own \([Scope]\) feature and this feature is
licensed in the Spec-TP. \(Each other\) is adjoined to the trace of this NP to identify its
domain and its \([Scope]\) feature is licensed by way of being bound by that carried by
the subject NP. Note that in this case, the two members of the subject chain receive
interpretations for plural NPs independently, so that partition applying to a plural NP
applies twice in this chain. The partition reading of (108) derives from this
representation in the following way: First, *those men* is interpreted according to the semantic translation (80), repeated below:

\[(113) \quad [\text{TP \ NP}_i \ [\ldots \ x_i \ \ldots \ ]] \text{ where } \text{NP}_i \text{ is a plural NP} \]
\[\rightarrow (\exists \Pi \ \text{NP}_i)(\forall x \in \Pi)[\ldots \ x \ \ldots \ ]\]

Then, *[each other]* is interpreted according to the semantic translation (102), repeated below:

\[(114) \quad [\alpha \text{ each other}_{i,j}]\varphi \rightarrow (\exists \Pi \alpha')(\forall x_i \forall x_j(x_i, x_j \in \Pi \land x_i \neq x_j))\varphi'\]

where \(\Pi\) is a partition defined in (21).

To apply these semantic translations to representation (112), we will have the following translation:

\[(115) \quad (\exists \Pi_i \text{ those men})(\forall X \in \Pi_i)(\exists \Pi_j X)(\forall x_i \forall x_j(x_i, x_j \in \Pi_j \land x_i \neq x_j))[x_i \text{ was hitting } x_j]\]

Suppose that *those men* consists of John, Bill, Tom and Mike, and that this set is partitioned by \(\Pi_i\) into two members: \{John, Bill\} and \{Tom, Mike\}. Suppose further that \(\Pi_j\), which takes these two members as its domain, partitions each set into atomic members. This leads to the partition reading in which John and Bill were hitting each other and Tom and Mike were also hitting each other. I refer the reader to Abe (1999b) for empirical evidence for this way of deriving the partition reading, and I will give just a piece of evidence to support it. Since Saito (1992), it has been frequently noted that an NP that undergoes clause-internal scrambling can serve as an A-binder of an anaphor in Japanese, as shown below:

\[(116) \quad a. \quad \text{A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga otagai-no}
\quad \text{group -Gen people and group -Gen people -Nom each other-Gen}
\quad \text{hahaoya-o kenasi-at-ta.}
\quad \text{mother -Acc criticize-Recip-Past}
\quad 'People of Group A and people of Group B criticized each other's mothers.'\]
b. A-gruupu-no hito-tati to B-gruupu-no hito-tati-o i otagai-no 
    group -Gen people and group -Gen people -Acc each other -Gen 
    hahaoya-ga t\_i kenasi-at-ta.
    mother -Nom criticize -Recip -Past

'People of Group A and people of Group B, each other's mothers criticized.' 

(116a) is a standard case where the anaphor otagai is bound by its antecedent in A-
position, the Spec-TP position in this case. (116b) shows that the object that 
undergoes clause-internal scrambling can serve as an A-binder of otagai occupying a 
position within the subject. If we compare these two acceptable sentences with 
respect to the availability of the partition reading, an interesting fact emerges: while 
(116a) allows this reading, (116b) does not. This fact follows immediately under the 
present analysis of reciprocal sentences. (116a) has the following LF representation 
for its partition reading:

(117)  \[
\text{TP} [\text{NP A-gruupu-no hito-tati to B-gruupu-no hito-tati]-gai}
\]
\[
\text{[Scope]}
\]
\[
\text{[vP [NP t\_i [D otagai]-no]_j,k [t\_k hahaoya]-o kenasi-at-ta]]}
\]
\[
\text{[Scope]}
\]

This representation is interpreted in the same way as (112), as given below:

(118)  \[(\exists \Pi_i \text{ people of Group A and people of Group B})(\forall X \in \Pi_i)
\]
\[(\exists \Pi_j X)(\forall x_i \forall x_j(x_i, x_j \in \Pi_j \land x_i \neq x_j)\{x_i \text{criticized } x_j \text{’s mother}]\]

Thus, (116a) can be true in the situation where people of Group A criticized each 
other's mothers and people of Group B did the same thing. Let us now consider what 
is a legitimate LF representation for (116b). Under the present assumptions, this 
sentence can have the following LF representation:

(119)  \[
\text{TP [NP A-gruupu-no hito-tati to B-gruupu-no hito-tati]-o_i [D otagai]-no]_j,k}
\]
\[
\text{[Scope]}
\]
\[
\text{[vP [t\_j hahaoya]-ga t\_k kenasi-at-ta]]}
\]
In this representation, \textit{[D otagai]} is adjoined to the object NP to identify its domain and its [Scope] feature is licensed in this position. Since the reciprocal is directly adjoined to its antecedent in this case, this representation will not produce the partition reading. In order to obtain an LF representation for this reading, \textit{[D otagai]} must be adjoined to the trace of its antecedent, but such movement is not permitted since it is lowering.\footnote{13} This explains why sentence (116b) does not have the partition reading.

We are now ready to examine whether reciprocal sentences can have the cumulative reading and the partition reading at the same time. Let us consider the following Japanese examples:

(120) a.  A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga otagai-ni
    group -Gen people and group-Gen people -Nom each other-Dat
    rokutuu-no tegami-o kaki-okuri-at-ta.
    six -Gen letter -Acc write-send-Recip-Past

'People of Group A and People of Group B wrote and sent six letters to each other.'

b.  A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga otagai-no
    group -Gen people and group -Gen people -Nom each other-Gen
    hahaoya-ni rokunin-no yuuzin-o syookaisi-at-ta.
    mother -Dat six -Gen friend -Acc introduce-Recip-Past

'People of Group A and people of Group B introduced six friends of theirs to each other's mothers.'

In order to obtain the partition reading, (120a), for instance, must be assigned the following representation:

(121) \[
\begin{array}{l}
TP \left[ NP \ A \text{-}gruupu-no \hitotati \to \ B \text{-}gruupu-no \hitotati \right]_i \text{-}ga \\
\left[ \text{Scope} \right] \\
\left[ \text{vP} \left[ NP \ t_i \left[ D \text{ otagai} \right]_n \right]_j,k \ f_k \left[ \text{rokutuu-no tegami} \right]_n \text{-}o \ kaki-okuri-at-ta \right] \\
\left[ \text{Scope} \right] \left[ \text{Scope} \right]
\end{array}
\]
Here, the subject in Spec-TP has its own [Scope] feature and this feature is licensed in this position.  \[D otagai\]-\[ni\] is adjoined to the trace of the subject to identify its domain and its [Scope] feature is licensed by way of being bound by that carried by the subject.  Now in order to obtain the cumulative reading between the SUB A-gruupu-no hito-tati to B-gruupu-no hito-tati 'people of group A and people of group B' and the DO rokutuu-no tegami 'six letters' on top of the partition reading, the latter NP needs to be adjoined to the former in (121).  There are two possibilities, depending upon which member of the subject chain is chosen as its target position; one is to adjoin to the whole NP in Spec-vP, as in (122), and the other is to adjoin to the head of the chain in question in Spec-TP, as in (123).

(122)  \[TP \[NP A-gruupu-no hito-tati to B-gruupu-no hito-tati\]i-ga

\[\text{[Scope]} \]
\[vP \[NP \[NP t_1 \[D otagai\]-\[ni\]j,k \[NP rokutuu-no tegami\]-o\]l \[NP kaki-okuri-atta\]\] \[\text{[Scope]}\]

(123)  \[^*\text{TP \[NP A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga\]i} \]

\[\text{[Scope]} \]
\[NP \[NP rokutuu-no tegami\]-o\]l \[vP \[NP \[NP D otagai\]-\[ni\]j,k \[NP kaki-okuri-atta\]\] \[\text{[Scope]}\]

(123) is in violation of the CCQR, since the adjunction of the DO rokutuu-no tegami 'six letters' to the SUB in Spec-TP crosses \[D-oetagai\], which carries [Scope].  Hence, we predict that the interpretations that would be derived from (123) should be missing for sentence (120a).  This is in fact borne out.  Let us consider how each representation is interpreted according to our semantic translations.  (122) is interpreted as in (124) and (123) as in (125).

(124)  (\(\exists \Pi_i \text{ people of Group A and people of Group B}) (\forall X \in \Pi_i)(\exists \Pi_j X)

(\(\exists \Pi_i \text{ six letters}) (\forall x_i \forall x_j(x_i, x_j \in \Pi_j \land x_i \neq x_j) \exists y (y \in \Pi_j)[x_i \text{ wrote and sent } y \text{ to } x_j] \land \forall w(w \in \Pi_i) \exists z_i \exists z_j(z_i, z_j \in \Pi_j \land z_i \neq z_j)[z_i \text{ wrote and sent } w \text{ to } z_j])]

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Suppose that people of Groups A and B are partitioned by \( \Pi_i \) into two members: people of Group A and people of Group B. Then, (124) is paraphrased as the following: People of Group A wrote and sent six letters to each other and people of Group B also wrote and sent six letters to each other. Notice that in (124), *six letters* is under the scope of the universal quantification over the members of \( \Pi_i \), and hence the six letters people of Group A wrote and sent to each other can be different from those which people of Group B wrote and sent to each other, so that the total number of letters involved can be twelve. In (125), in contrast, the number of letters involved must be six. Suppose that these six letters are partitioned by \( \Pi_i \) into the atomic members: \( L_1, L_2, L_3, L_4, L_5, L_6 \). Then, the following situation satisfies the truth conditions described in (125):

(126) a. People of Group A wrote and sent \( L_1, L_2, L_3, L_4 \) to each other.

b. People of Group B wrote and sent \( L_5, L_6 \) to each other.

According to our prediction, this reading should be missing for sentence (120a), and the fact meets this prediction; that is, when this sentence is interpreted so as to have both the partition reading and the cumulative reading at a time, the cumulative reading must hold between six letters and the members of \( \Pi_i \) of the whole set of people of Groups A and B, and not between six letters and that set itself. The same thing holds true for sentence (120b); that is, this sentence cannot be true in the following situation, where \( F_1, F_2, F_3, F_4, F_5, F_6 \) represent the members of six friends:

(127) a. People of Group A introduced \( F_1, F_2, F_3, F_4 \) to each other's mothers.

b. People of Group B introduced \( F_5, F_6 \) to each other's mothers.

And this sentence can be true in the situation where people of Group A introduced six friends to each other's mothers and people of Group B introduced (possibly different) six friends to each other's mothers.
Interestingly, the missing interpretations can become available to the sentences in (120) when the DOs are scrambled before the IOs, as shown below:

(128) a. A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga rokutuu-no
group-Gen people and group-Gen people -Nom six -Gen
tegami-o t i otagai-ni t i kaki-okuri-at-ta.
letter -Acc each other-Dat write-send-Recip-Past
'People of Group A and People of Group wrote and sent six letters to each other.'

b. A-gruupu-no hito-tati to B-gruupu-no hito-tati-ga rokunin-no
group -Gen people and group-Gen people -Nom six -Gen
yuuzin-o otagai-no hahaoya-ni t i syookaisi-at-ta.
friend -Acc each other-Gen mother -Dat introduce-Recip-Past
'People of Group A and people of Group B introduced six friends of theirs to each other's mothers.'

The interpretations that are missing for the sentences in (120) are much easier to obtain with these sentences. This fact is straightforwardly explained if it is assumed, following Saito (1985), that a phrase can be adjoined to any maximal category by scrambling. Suppose that the DO rokutuu-no tegami-o 'six letters' in (128a), for instance, is adjoined to vP. Then, either (129a) or (129b) is derived, depending upon whether the [Scope] feature is carried along by scrambling or not.

(129) a. \[TP [A-gruupu-no hito-tati to B-gruupu-no hito-tati]-ga_i [vP [rokutuu-no
tegami]-o_j [vP t_i [D otagai]-ni t_j kaki-okuri-at-ta]]]  
[Scope]  

b. \[TP [A-gruupu-no hito-tati to B-gruupu-no hito-tati]-ga_i [vP [rokutuu-no
tegami]-o_j [vP t_i [D otagai]-ni t_j kaki-okuri-at-ta]]]  
[Scope]
In order to obtain the partition reading, \(D\ otagai-ni\) is adjoined to the trace of the SUB at LF, thus the representations in (129) being mapped onto the following representations:

\[(130)\]

\[(130a)\]

\[\text{TP} [A\text{-}gruupu\text{-}no\ hito\text{-}tati\ to\ B\text{-}gruupu\text{-}no\ hito\text{-}tati]\text{-}gai [vP \text{rokutuu\text{-}no tegami}\text{-}o_j [vP [t_t [D\ otagai]\text{-}ni]}_k,l t_t kaki\text{-}okuri\text{-}at\text{-}ta]]\]

\[(130b)\]

\[\text{TP} [A\text{-}gruupu\text{-}no\ hito\text{-}tati\ to\ B\text{-}gruupu\text{-}no\ hito\text{-}tati]\text{-}gai [vP \text{rokutuu\text{-}no tegami}\text{-}o_j [vP [t_t [D\ otagai]\text{-}ni]}_k,l t_t kaki\text{-}okuri\text{-}at\text{-}ta]]\]

Further, in order to obtain the cumulative reading between the SUB and the DO, \(\text{rokutuu\text{-}no tegami}\text{-}o\) in (130a) can be adjoined to the SUB in Spec-TP without violating the CCQR. This derives the interpretations stated in (125). In (130b), the trace of \(\text{rokutuu\text{-}no tegami}\text{-}o\), which carries its [Scope] feature, can adjoin to the whole NP in Spec-vP without violating the CCQR, thereby deriving the interpretations stated in (124). This correctly explains why the missing interpretations can become available to (128a) when the DO is scrambled before the IO. Exactly the same analysis applies to sentence (128b).

To summarize this section, I have argued that QR is involved in deriving the cumulative readings of plural NPs and the appropriate interpretations of reciprocals, by showing that the CCQR, which captures the rigidity effects on QR, constrains deriving the cumulative reading of plural NPs and the partition reading of a reciprocal at a time in a given sentence.

4.2. Clause-boundedness and Condition A

Finally, I will briefly mention how reciprocals are constrained by the MCL, which captures the clause-boundedness of QR. At first sight, reciprocals can violate
this condition, since they can take their antecedents in higher clauses, as illustrated below:

(131) a.  John to Mary-wa [otagai-no hahaoya-ga kasikoi to] omotteiru.
    and   -Top each other-Gen mother -Nom smart   Comp think
    'John and Mary think that each other's mothers are smart.'

    and   -Top each other-Nom smart   Comp think
    'John and Mary think that each other is smart.'

Under the present assumptions, (131b), for instance, has the following LF representation:

    [Scope] omotteiru]

In this representation, [D otagai]-ga is adjoined to John to Mary-wa in the matrix Spec-TP at LF to identify its domain and its [Scope] feature is also licensed in this position. This movement, however, appears to violate the MCL, since it skipped a possible landing site in which the feature [Scope] could be licensed, i.e., the embedded TP-adjoined position. The question is why the sentences in (131) are acceptable despite their apparent violations of the MCL.

Notice that reciprocals differ from other normal quantifiers carrying [Scope] in that they lack domains over which they can apply their quantification, so they need to adjoin to NPs before they move to positions where they take scope. In other words, reciprocals need to have two steps of movement, one for finding NPs to which they apply their quantification and the other for taking scope. I claimed above that sentence (74), repeated here as (133), involves two steps of movement, as shown in (75), repeated here as (134).

(133)  John introduced the guests to each other.
(134) a. \[\text{TP } \text{John}_i [vP t_i \text{ introduced } [\text{NP } [\text{NP the guests}_j [\text{each other}]_k, l \text{ to } t_l]]]\]

[Scope]

b. \[\text{TP } [\text{NP } [\text{NP the guests}_j [\text{each other}]_k, l ] \text{ TP } \text{John}_i [vP t_i \text{ introduced } t_k \text{ to } t_l]]\]

[Scope]

In (134a), \textit{each other} is adjoined to \textit{the guests} to identify its domain, and then the whole NP is adjoined to TP to license the [Scope] feature, as shown in (134b).

Given this, it is natural to consider that it is the second step of movement that is subject to the MCL in reciprocals and further that the first step of movement is subject to Condition A. That the Japanese reciprocal \textit{otagai} is subject to Condition A has been observed in the literature (see Yang (1984) and Ueda (1986), among others); compare the sentences in (131) with the following sentences:\textsuperscript{14}

(135) a. \textit{*John to Mary\text{-}wa [Bill\text{-}ga otagai\text{-}o nikundeiru to] omotteiru.}

\text{and -Top -Nom each other-Acc hate Comp think}

'John and Mary think that Bill hates each other.'

b. \textit{*John to Mary\text{-}wa [Bill\text{-}ga otagai\text{-}no haoya\text{-}o nikundeiru to] omotteiru.}

\text{and -Top -Nom each other-Gen mother -Acc hate Comp think}

'o m o t t e i r u .

think

'John and Mary think that Bill hates each other's mothers.'

In Abe (1993a), I claimed that Condition A is derived from a modified version of the MCL. This condition, as long as it applies to reciprocals, will be characterized as follows, in the present terms:

(136) When reciprocals undergo movement to identify its domain, it cannot skip a possible landing site.

where a possible landing site for a reciprocal is one where it could have identified its domain. Given this characterization, the sentences in (135) are ruled out by Condition A, since, when \textit{[D otagai]} is adjoined to the matrix subject, this adjunction crosses the embedded subject \textit{Bill}, in which the reciprocal could have identified its
domain. On the other hand, in (132), the adjunction of \([D \text{ otagai}]\-ga\) to the matrix subject does not violate Condition A, since the matrix subject is the most local NP to which the reciprocal can adjoin to identify its domain. Notice that the embedded TP-adjoined position is not a possible landing site for \([D \text{ otagai}-ga]\) since this reciprocal cannot identify its domain in that position. In short, reciprocals involve two steps of movement and each step of movement is constrained by different minimality conditions: the first step is subject to Condition A, characterized in (136), and the second is subject to the MCL applying to QR, in which a possible landing for this step of movement is one where a reciprocal can take scope.

5. Conclusion

I have argued that QR is involved in deriving the cumulative readings of plural sentences and the appropriate interpretations of reciprocal sentences. Under the assumption made by Abe (1993a) that QR is characterized as movement for satisfying the semantic feature [Scope] in a position where a given QP takes scope, it was argued (i) that the proper representations for the cumulative readings of plural sentences are derived by what we call absorption operation, in which one QP is adjoined to another to satisfy its [Scope] feature and (ii) that this adjunction operation is subject to both the MCL, which derives the clause-boundedness of QR, and the CCQR, which captures the rigidity effects of QR. Further, I argued, following HLM, that reciprocal sentences involve LF adjunction of reciprocals to their antecedents. It was shown that this adjunction operation is subject to the CCQR, thus indicating that it is QR, i.e., a movement to satisfy a [Scope] feature. This claim was further supported by the fact that some restrictions are imposed upon the availability of both the cumulative reading holding between plural NPs and the partition reading holding between one of the plural NPs and a reciprocal. It was shown that these restrictions are straightforwardly explained as results from the interactions between the adjunction operations involved in deriving the cumulative readings and those involved in
deriving the partition readings with respect to the CCQR. Finally, it was argued that an apparent violation of the clause-boundedness of reciprocals is accounted for by assuming that the MCL imposed upon QR applies to the second step of movement of reciprocals and that the first step is subject instead to Condition A.

We can now see that QR is more involved in deriving proper interpretations for the LF interface than it has been assumed to be. Thus, this provides strong empirical evidence for the claim that QR is involved in the derivations of the computational component of the language faculty. To the extent that this is on the right track, it will cast serious doubt on the move according to which QR should be dispensed with under the Minimalist Program.15
NOTES

1 See Abe (1999a) for more evidence to show that the MCL constrains the application of QR. In particular, it is argued there that the scope interaction between QPs that undergo long distance scrambling and other QPs in Japanese is naturally explained under this proposal. See also Abe (1993a, 1999a) for the claim that QR is subject to the Last Resort Principle.

2 Given the clause-boundedness of QR, it will have to be stipulated that these two occurrences of [Scope] must be in the same clausal domain. Or it may suffice to say that the licensing by (11) is a marked option, so that it is available only if the satisfaction of [Scope] by movement is impossible.

3 I assume throughout that the denotation of ||the N|| is the same as that of ||all the N|| for plural NPs.

4 Strictly speaking, Langendoen (1978) does not use the notion of partition in formulating the truth conditions but rather uses what amounts to covering, defined in (21). Since no discussion in the text hinges upon the choice of these two notions, I will stick to the notion of partition for simplicity. See Gillon (1987) for relevant discussion.

5 If for someone is added to this sentence, the new sentence can mean that each member of a partition of the set of three directors has made possibly different five movies in such a way that that member has made each member of a partition of the set of the five movies for a possibly different person.

6 As far as I can see, this operation of one phrase being adjoined to another is first proposed by Saito (1994) in order to account for the effects of wh-arguments "saving" wh-adjuncts within islands in Japanese. See also Sohn (1994) for the argument that this operation is exploited in multiple scrambling in Japanese and Korean.

7 A question arises here as to whether or not the long distance scrambling of hutari-no onna-ni in (50) violates the CCQR, given in (14). It depends on whether
we can take the [Scope] feature to be carried along as a free ride when *hutari-no onna-ni* is scrambled to the matrix TP-adjoined position. If we regard each step of movement as a separate operation, (50) may violate the CCQR, since the adjunction to the embedded TP is solely for satisfying the [Scope] of *hutari-no onna*. On the other hand, if we adopt the notion of Form-Chain, proposed by Chomsky (1993), there is a good sense in which the step of adjoining *hutari-no onna-ni* to the embedded TP is taken as an intermediate step of a larger operation whose destination is the matrix TP-adjoined position for scrambling. Under this assumption, the [Scope] of *hutari-no onna* is naturally taken to be carried along as a free ride, hence satisfying the CCQR. See Abe (1999a) for more precise explanations.

8 See Fodor and Sag (1982) for the claim that indefinites are ambiguous between their quantificational and referential uses.

9 I have used indefinite NPs in the text as those which intervene between the two plural NPs that undergo absorption operation. As Yasuaki Abe (personal communication) pointed out to me, it is predicted under the present assumptions that universal quantifiers and other plural NPs should also block the absorption operation in question. Thus, if the indefinite NP *dareka sensee-ni* in (58) is replaced by a universal quantifier such as *dono sensee-ni-mo* 'every teacher' as in (i) or by a plural NP such as *sono sensee-tati-ni* 'those teachers' as in (ii), the cumulative reading between the SUB NP and the DO NP should be impossible.

(i)  *Sono onnanoko-tati-ga  dono sensee-ni-mo sorera-no  tabemono-o   ageta.*  
    that girls -Nom every teacher-Dat those-Gen food -Acc gave  
    'Those girls gave every teacher those foods.'

(ii)  *Sono onnanoko-tati-ga  sono sensee-tati-ni sorera-no  tabemono-o ageta.*  
     that girls -Nom that teachers -Dat those -Gen food-Acc gave  
     'Those girls gave those teachers those foods.'

It is rather hard to make the relevant judgments, but it seems to me that the cumulative reading in question is very hard to obtain. Anyway, it is easier to make judgments
when indefinite NPs are involved. For this reason, I will continue to use such patterns when the availability of the cumulative reading is at stake.

10 In footnote 1, I referred to Abe (1993a, 1999a) for the claim that QR is subject to the Last Resort Principle. If this is the case, then the objects in question in (67) cannot be adjoined to other objects to undergo absorption operation, since they have already occupied positions where they can take scope, i.e., the TP-adjoined positions. One way to circumvent this problem is to assume, following Nishida (1999), that multiple scrambling is in fact prohibited just as multiple topicalization is, and to claim that those phrases that appear to be multiply scrambled are not raised separately but rather the whole phrase is raised together after they become constituents by one phrase adjoining to the other. If this is the case, then the absorption operation in question is done as a free ride once "multiple" scrambling takes place.

11 Contrary to what Gillon (1984) says, (79) also has the reading in which the men admire each other and the women admire each other. This will be referred to as the partition reading below.

12 See Langendoen (1978) and Abe (1992, 1999b) for relevant discussions. Note further that Fiengo and Lasnik (1973) consider only the cases where atomic members are involved in reciprocity, so that in (109), each member of $S_i$ is taken as atomic. This is too restrictive and non-atomic members should also be admitted for reciprocity in $S_i$.

13 I am tacitly assuming that the NP to which a reciprocal is adjoined does not carry its own [Scope] feature. Thus, the scrambled object in (119) is assumed not to have such a feature. If it did, it would give rise to a configuration of absorption operation for the cumulative reading. This would lead the representation to be unintelligible since reciprocals cannot participate in creating the cumulative reading as their inherent properties.
14 It has been also observed in the literature (see Yang (1984) and Ueda (1986), among others) that Japanese anaphors are not sensitive to the Nominative Island Condition (NIC), unlike English anaphors. I follow Chomsky (1986) in that Condition A captures so-called Specified Subject Condition effects and the NIC effects are derived from some other condition.

15 See Abe (1992, 1993a) for the question of how reflexivity is represented at LF. It is argued there that reflexives, unlike plural NPs and reciprocals, do not undergo QR but rather are licensed as bound variables at LF.
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