6.1 Introduction

In chapter 4, I discussed a number of examples from the literature that were used to argue for the sets theory. The arguments all involved first finding a pair of noun phrases that in some models would be coreferent only on the union theory and then finding a predicate that in certain situations would appear to be true of one member of the pair and not the other. (235) below was an example considered in a model in which the young and old animals are just the cows and the pigs:

(235)  
a. The cows and the pigs were separated.
b. The young animals and the old animals were separated.

What I argued there was that although there is a difference between a. and b., even in the model described, in at least some speech contexts, a. and b. would say the same thing. I didn’t spell out what exactly the source of these differences were and I want to attempt that here.

I have chosen to reopen this issue at this point, after having discussed distributivity, for two reasons. On the one hand, the story I will tell here is very much like the one told in the previous chapter. Here again, I think the sets theorist has misanalyzed pragmatic effects as semantic ones. On the other hand, it is important to have the two discussions near each other because despite the similarity of the two, the context dependence to be studied here is not just an instance of distributivity.

To begin, we review some of the evidence from chapter 4. Besides the pair in (235), we had the following pairs:

(236)  
a. The cows and the pigs talked to each other.
b. The young animals and the old animals talked to each other.
(237)  a. The cows and the pigs were given different foods.
   b. The young animals and the old animals were given different foods.

In each case, the subject NPs are different and this leads to a difference of meaning (in a broad sense) between the resulting pairs. One might think that these differences are explained by the theory of distributivity from chapter 5 and this is in fact not far from what we will ultimately say. Nevertheless, these are not just more examples of the chapter 5 kind. This is made obvious by considering the examples in (238) and (239), often claimed to be paraphrases of different readings of the examples in (236):

(238)  a. The cows talked to each other and the pigs talked to each other.
   b. The young animals talked to each other and the old animals talked to each other.

(239)  a. The cows talked to the pigs and the pigs talked to the cows.
   b. The young animals talked to the old animals and the old animals talked to the young animals.

It is clear how the theory of chapter 5 would handle the reading in (238) but this leaves us wondering about the reading of (236) in (239). Similar remarks apply to the other examples discussed in chapter 4. So what is it about the verb phrases used in those examples that give rise to the differences appealed to by the sets theorist, differences like those spelled out in (239)?

As Löning (1989:§6.6) points out in connection with many of the same examples, they critically depend on predicates that are reciprocal. Some of these predicates involve overt reciprocal anaphors such as each other. Others, such as be separated, while they lack an explicit reciprocal nonetheless have a reciprocal meaning. The addition of an explicit reciprocal is meaning preserving: 29,30

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29 I am ignoring another reading of were separated which is paraphrased as were separated from them/him. Not all predicates for which the addition of an overt reciprocal is meaning preserving have this other reading. For example: left together (= left together with one another) and collided (= collided with one another) don’t have this other reading.

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30 Since we are considering reciprocals, the above was to be expected.

6.2 Reciprocals

Reciprocals are interesting because those that are overt may not be

those that are covert. However, they can be divided into two groups: the singular ones, such as each other, and

the plural ones, such as one another. This is not simply a matter of

existence; it is also possible to have

both singular situations which do not

cheat us or quantify over the

exponent.

As in the case of the NPs,

(i) The cows and the pigs talked
to each other.
(ii) The young animals and the

old animals talked to each other.

This compares to more

natural

(iii) The cows talked to the pigs

and the pigs talked to the cows.
(iv) The young animals talked to

the old animals and the old

animals talked to the young

animals.

Since we are considering

reciprocals, the above was to be

expected.
Reciprocity

(240) a. John and Mary were separated.
b. John and Mary were separated from each other.
c. John and Mary ate different foods.
d. John and Mary ate foods that were different from each other.

This data should be compared with that in (241) in which, as has often been pointed out, the addition of a reciprocal is not meaning preserving:

(241) a. John and Mary listened.
b. John and Mary listened to each other.
c. John and Mary met angry men.
d. John and Mary met men that were angry at one another.

Since the predicates that give rise to the phenomenon in chapter 4 are all reciprocal, our attention is now turned to properties of reciprocals.

6.2 Reciprocals

There is a tradition in the study of reciprocals which takes as a premise that the truth conditions for reciprocal sentences, in particular those of the form NP Verb each other or NP Verb Preposition each other, can be expressed as quantification statements whose domain is the set of singularities and pluralities that are part of the denotation of the subject NP and whose predicates are the transitive verb whose object is each other as well as a distinctness predicate. The most common instantiation of this idea is what Langendoen (1978) calls Strong Reciprocity, according to which the sentence the boys cheat each other is true just in case every boy cheats every other boy. Note the elements making up this requirement: quantifier: every, main predicate: cheat, distinctness: other. Strong

\[30\] Langendoen (1978:§6) argues based on the discussion in Leonard and Goodman (1940:51) that (i) and (ii) below differ in meaning:

(i) They are similar to one another.
(ii) They are similar.

As I understand it, the claim is that for (ii) to be true there must be some one respect such that each of them is similar in that respect to the other whereas (i) may be true as long as each of them is similar in some respect to the other. If this is correct, then both verb phrases in (i-ii) are reciprocal, they are just not synonymous.
Reciprocity works best if one's data is limited to sentences whose subjects denote two-membered pluralities, such as *John and Mary*. But Strong Reciprocity doesn't seem to be required in every case, as we shall shortly see, and so alternatives to Strong Reciprocity have been suggested. These involve varying the domain of quantification to include quantification over pluralities and varying the quantifiers themselves. The following three samples should give an idea of the range of these proposals. Langendoen (1978) discusses a requirement he calls Weak Reciprocity for Subsets. According to this requirement, a sentence of the form NP V each other is true just in case every individual in the subject's referent V's or is part of a group that V's a group it's not a member of and every individual is V-ed or is part of group that is V-ed by a group it's not a member of. If these are the truth conditions for Langendoen's *the prisoners released each other* and Max is a prisoner then he must have helped to release some other prisoners and he must have been released by prisoners other than himself.

Fiengo and Lasnik (1973) propose that some reciprocal sentences are true if there exists a partition of the denotation of the subject noun phrase such that Strong Reciprocity holds within the cells of the partition. The sentence *the men are hitting each other* would be true according to Fiengo and Lasnik in a situation where the men are standing in pairs (= cells of a partition) and everyone is hitting his and only his pairmate. Finally, in Roberts (1987:141-143) we find a proposal based on a suggestion of Emmon Bach's to use the quantifier ENOUGH which specifies an amount but, as with *many* and *few*, the amount it specifies is context dependent. On this proposal, a sentence of the form NP V each other is true if enough individuals V enough individuals distinct from them and enough individuals are V-ed by enough individuals distinct from them.

Most of these proposals appear to impose requirements that are too strong as Langendoen (1978) and Fiengo and Lasnik (1973) have shown. For example *the boys kissed each other* is intuitively true even if not every single boy kissed every other boy, that is, even if there is no Strong Reciprocity. Most speakers agree that that sentence is not falsified, intuitively, just because one inaccessible boy out of a large group was not kissed. This means that the requirement of Strong Reciprocity in the cells of a partition is also too strong. Even Weak Reciprocity for Subsets appears to be too strong for this case, though that would depend on whether we want to say that this requirement is met if the inaccessible boy was in a group of boys that did get kissed. Roberts' proposal is not counterexemplified in this case, since presumably enough of the boys kissed and were kissed to make the sentence true.

On the other hand, many of these proposals appear in some instances not to be strong enough as the above authors have also shown.

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An example:

There is an obvious way to apply this requirement (242) in such a situation if it is an essential feature of the prisoners' experience. But that is not enough. The prisoners may not be in the situation of seeing each other. In fact, more precisely, in fact, perhaps, the prisoners are not in the situation of seeing each other. So even if the prisoners are not in the situation of seeing each other, it is not enough for the prisoners to be in the situation of each other seeing each other.

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(242)
An example of this problem which will be of interest to us is the following:

(242) The prisoners on the two sides of the room could see each other.

There are readings of (242) in which the predicate could see each other applies distributively to prisoner subgroups. Setting these readings aside, (242) is likely to be interpreted in such a way that it is judged false in a situation in which there are prisoners on both sides of the room and there is an opaque barrier between them. However, assuming that a prisoner can see anyone on his side of the barrier, Weak Reciprocity is met since every prisoner sees and is seen by some other prisoner and yet (242) is judged false. Furthermore, there is a way to partition the prisoners, namely into sides of the room, such that Strong Reciprocity is met within each cell of the partition, so Fiengo and Lasnik's condition is met as well. Finally, consider Robert's proposal. On this proposal, if (242) is false in the situation described it is because there are some context dependent amounts of seeing prisoners and seen prisoners required to make it true and there are not enough such prisoners in this situation. However, we could make one of the groups very, very large and the other very small, so that most of the prisoners are in the large group. Now there are more seeing prisoners and more seen prisoners. Eventually we should hit the required amounts. But in fact, no matter how large the larger group is, if the barrier stays opaque, (242) stays false.

Langendoen's Weak Reciprocity for Subsets does seem to be at least partially correct as truth conditions for reciprocal sentences in that it demands that reciprocity hold between parts or subpluralities of the plurality denoted by the subject of the reciprocal predicate. What the above example shows however is that reciprocity need not hold between every two subpluralities nor it is sufficient if it holds between just some subpluralities. Rather there are particular subpluralities — the two groups on either side of the barrier in the case of (242) — between which reciprocity must hold. I would suggest therefore, that all the semantics of reciprocals should say is that there is reciprocity between certain subpluralities of the plurality denoted by the subject of the reciprocal predicate. Identification of the particular subpluralities involved, what I will call the "operative subpluralities," should be left open in the semantics of the reciprocal predicate and will, at least in some cases, be determined by the context. Previous research on reciprocals has uncovered a rich variety of factors that affect the interpretation of reciprocals, however the insistence on a context independent semantics for reciprocals has left us with no place to incorporate these observations into a single semantic rule for reciprocals. My conclusion then is that Roberts was on the right track
in including context sensitivity in her proposal. However, the force of the quantifier is not the only factor that is sensitive to context.

In order to get an idea of how one could modify earlier approaches to reciprocity to allow for the right kind of context dependence, I will write a set of truth conditions for a sentence of the form "NP V (Prep) each other" based on these earlier approaches.

(243) A reciprocal verb phrase applies truthfully to a noun phrase denoting plurality S, if:

a) There are two or more operative subpluralities of S (a subplurality may be a singularity). Every member of S is contained in an operative subplurality.

b) There is a relation Recip among the operative subpluralities. Every subplurality bears the Recip relation to some other subplurality. If \( <x, y> \in \text{Recip} \), then \( x \) and \( y \) are non-overlapping.

c) Recip is a subset of the extension of the main predicate (transitive verb or verb + preposition).

There are at least two places where these conditions are susceptible to contextual refinement. The context may determine the operative subpluralities and it may determine the relation Recip. In the following section we will look at some evidence of the context dependence suggested here. However, even before we take the effects of context into account, we may note some correct predictions made by these conditions. It requires John to have tolerated Mary and vice versa for the sentence John and Mary tolerated each other to be true. The requirements in (243a) and (243b) guarantee that John and Mary both be operative subpluralities in this case. Next, note that if every individual in S is a subplurality, in other words if S itself just is the set of subpluralities, and if Recip = \( \{ <x, y>: x, y \in S, x \neq y \} \), then these conditions amount to Strong Reciprocity.

6.3 Reciprocals in Context

This subsection contains examples that are meant to exhibit the role of context in the interpretation of reciprocals. The first is our familiar:

(244) The cows and the pigs were separated.
The noun phrase *the cows and the pigs* presupposes the presence in the context of two discourse referents, one for each conjunct. A prominent interpretation of (244) involves identifying these referents with the operative subpluralities used in interpreting the reciprocal verb phrase along the lines of (243) above. This requires that the cows were separated from the pigs and the pigs were separated from the cows. It is tempting at this juncture to conclude that the subpluralities mentioned in (243) above behave like pronominal elements and so they are identified with available discourse referents.

In (244), the sources of the operative subpluralities were themselves NP conjuncts in the subject of the reciprocal VP. It was this fact that led the sets theorists astray. However, one can also find examples in which the source of the operative subpluralities is not itself an argument of the reciprocal predicate. A case in point is the following quote from U.S. President Clinton’s 1993 Inaugural Address:

(245) But for fate, we - the fortunate and the unfortunate - might have been each other.

It is interesting to note here that the subpluralities are being identified by NPs that occur inside a non-restrictive relative. This effect appears somewhat surprising in light of the observation in the previous chapter (example 227) that non-restrictive relatives apparently cannot be used to provide a partition variable for the Part-operator.

So far we have seen examples that fall under the generalization that operative subpluralities are identified as the referents of noun phrases occurring in the discourse prior to the reciprocal. However, a wider range of examples shows that even this is not always the case. The following examples give some indication of the range of possibilities:

(242) The prisoners on the two sides of the room could see each other.

(246) Farmer Smith and Farmer Jones said that although their cows could stay together, the pigs *had to be separated*.

(247) a. The people in that building come from different but bordering countries. Not surprisingly, they *hate each other*.

b. The people in that building are on varying rent schedules, depending on when they first came into the building. Not surprisingly, they *hate each other*.
(248) a. The lawyers representing the cows and the pigs hated each other.
b. The lawyers representing the young animals and the old animals hated each other.

Up to this point, we have seen examples where the context provides a salient set of operative subpluralities. We have yet to see an example where the context affects the choice for the Recip relation mentioned in (243b,c). One such case is the example in (249) below from Fiengo and Lasnik (1973:454, fn4) in which the linguistic form of the subject NP appears to be involved in determining the relation Recip:

(249) The husbands and wives in the room are similar to each other.

Fiengo and Lasnik interpret this sentence in such a way that all the pairs in Recip are husband-wife pairs. Assuming the noun phrase the husbands and wives names a plurality made up of singularities (pace Link 1984), somehow referring to that plurality in this particular way, leads to a choice of Recip along marriage lines. According to (243c) then, the extension of similar must include all husband-wife pairs.

As in the case of distributivity, sometimes the relation Recip is presented graphically. In fact, the same example can be use here, this time with a sentence containing a reciprocal:

(250) The books in the chart below complement each other.

<table>
<thead>
<tr>
<th>Fiction</th>
<th>Non-fiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice in Wonderland</td>
<td>Aspects</td>
</tr>
<tr>
<td></td>
<td>Language (Bloomfield)</td>
</tr>
<tr>
<td>Fantastic Voyage</td>
<td>Gray’s Anatomy</td>
</tr>
<tr>
<td>David Copperfield, Hard Times</td>
<td>Das Kapital, The Wealth of Nations</td>
</tr>
<tr>
<td>Oedipus Rex, Agamemnon</td>
<td>Freud’s Intro. to Psychology</td>
</tr>
<tr>
<td>Richard III</td>
<td>Machiavelli’s The Prince</td>
</tr>
</tbody>
</table>

The operative subpluralities are determined in this case by the chart itself.

Reciprocal sentences and the quality of the objects of which the relations are assumed to be subplurality relations are among the two factors that influence the appropriateness of Recip here. Although the types of the objects do not have to be dictionary-structural ones, the book complement example of (250) objects—a dissertation—is a mean of any object. The book, any book, is a predictable completer.

determined by the partition of the set of objects. The limits of the operative subpluralities are that is
Reciprocity

along with certain chart reading conventions. The operative subpluralities of books are those that occupy discrete cells in the chart. The relation of "complementing" mentioned in (250) is understood to apply reciprocally between these. If the chart was rearranged, the meaning of the utterance in (250) would change as well, even if the same cells were on the rearranged chart. This means that the relation Recip is also 'spelled out' by the arrangement of the chart. Elements of the Recip relation consist of pairs corresponding to the rows of the chart.

Summarizing then, the interpretation of a reciprocal depends in some cases on the context. This sensitivity is not quantitative but rather qualitative, the context tells us which individuals should bear a relation to which others. Furthermore, as we saw in the previous chapter, a central assumption of the sets theory is that the identity of the operative subpluralities is built into the meaning of the predicates themselves. Thus the two subpluralities of cows and pigs form separate units of an element in the extension of the verb phrase in (244), were separated. While this approach may work for (244), it will not work for the other examples given here. The chart example shows this best. A theory that is bent on keeping the operative subpluralities distinct in the extensions of predicates would have the predicate in this case apply to some special type of group whose structure was determined via a mapping from the chart. The noun phrase the books in this chart in (250) would then have to denote this complex object and that would explain why a change in the chart would effect the meaning of the utterance. The problem is that there does not seem to be any compositional way to get the noun phrase in this case to denote anything but a simple plurality, assuming that book in this chart is a predicate true of any book in the chart.

In some of the preceding examples, the Recip relation was determined non-linguistically or semi-linguistically. As in the case of the partitions discussed in the previous chapter, here too we have reached the limits of our linguistic research. How exactly a given relation is made salient based on non-linguistic or extragrammatical reasoning is a matter that is beyond the scope of the present investigation.

Finally, although we have argued that context may serve to flesh out the truth conditions described in (243) above, that is not always the case. Often, there seems to be some default reasoning. The simple examples that were originally used to argue for Strong Reciprocity seem to show this. In a recent paper, Dalrymple et. al (1994) classify a set of possible ‘meanings’ for reciprocal statements in terms of their logical properties. They then propose that reciprocal statements express the strongest possible candidate among these possible meanings that is consistent with properties of the relation expressed by the scope of the
reciprocal (= the main verb for the kind of cases considered in (243)) as well as other non-linguistic information. It strikes me that this is a precise working out of the default mechanism alluded to here (Sauerland 1994b:18 makes a similar point).

6.4 Reciprocity and Distributivity

Up to now, I have been discussing reciprocity as an issue that is independent of what was said earlier about distributivity. Nevertheless, as pointed out above, much previous research has analyzed the one in terms of the other, often relying on intuitions stemming from the synonymy or near-synonymy of pairs such as:

(251) a. The boys each saw the other.
b. The boys saw each other.

where the distributive marker of (251a) floats into the reciprocal of (251b). Another tie with the discussion of distributivity are the operative subpluralities of the previous section which seem strikingly like the cells of the partitions invoked in our analysis of distributivity.

To show how the two phenomena could be combined, I will present an analysis of the reciprocal each other that makes crucial use of the partition operators of chapter 5. This type of analysis of the reciprocal follows closely the approach of Heim, Lasnik and May (1991b) as developed in Sauerland (1994b). Since use will be made of the Part operators, the account will be cast in a framework in which English is translated into a semantically interpreted language as in chapter 5.

As a preview, I will introduce the components of the analysis in terms of the truth conditions for verb phrases with reciprocal arguments given in (243) above, repeated here:

(243) A reciprocal verb phrase applies truthfully to a noun phrase denoting plurality S, if:

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31I cite Sauerland since I relied on his paper for the analysis spelled out here, however, the following caveat from his paper should be mentioned. "The largest part of this paper is a spelling out of class notes from Irene Heim's spring 1994 Advanced Semantics course at MIT." See also Sauerland (1994a).
Reciprocity

a) There are two or more operative subpluralities of S (a subplurality may be a singularity). Every member of S is contained in an operative subplurality.

b) There is a relation Recip among the operative subpluralities. Every subplurality bears the Recip relation to some other subplurality. If \( <x,y> \in \text{Recip} \), then \( x \) and \( y \) are non-overlapping.

c) Recip is a subset of the extension of the main predicate (transitive verb or verb+preposition).

The clause in (243a) looks like the semantics for our Part operator, and so we will reduce this to our analysis of distributivity. In particular, use will be made of the same cover variables to select the set of operative subpluralities. Turning next to (243b), for each operative subplurality \( P \) in the cover, there should be a different element of the cover which is paired with \( P \) in Recip. In the final analysis, we will not make reference to Recip directly, but to something related to it, as follows. Consider first the sum of all the elements of Recip paired with \( P \) in Recip. Since there is one such sum for each operative subplurality, we can speak of the function that picks out that sum for each subplurality. This function will be the meaning of the reciprocal, *each other*. This is summarized in (252) below, where \( \text{EachOther} \) is the translation of *each other*:

\[
\text{EachOther}(P) = \bigcup \{ s : <P,s> \in \text{Recip} \}
\]

(252) For every operative subplurality \( P \) in the cover:

This is roughly the analysis of *each other* to be presented. Changes will need to be made to allow it to fit together with the distributivity part of the proposal. Turning last to (243c), this requirement will simply follow from the composition of the meaning of *each other* with the meaning of the main verb. The translation in (253b) below for (253a) should give an idea of how that will happen:

(253) a. The boys saw each other.

b. \( \forall y[ (y \in b \land y \in \text{Cov}) \Rightarrow \text{saw}'(y)(\text{EachOther}(y))] \)

The contribution of the Part operator is evident here in the universal quantification over elements of the cover. Which subpluralities are operative is determined therefore by the assignment of a value to the free
cover variable. The expression "EachOther" is also meant to be a free variable, this one of type \(<e,e>\). The value of this variable determines which subplurals are related to which others. This is where the Recip relation is determined. Each other is being treated in a way similar to Cooper's (1979) treatment of donkey pronouns, with a free function variable applied to another variable bound from above. In the case of the reciprocal, the bound variable is bound by the distributivity operator.

In order to make this account work, the semantics for the Part operator needs to be adjusted so that it is capable of variable binding. In addition, more needs to be said about the function EachOther in the translation of the reciprocal. Unlike Cooper pronouns in general, not just any type \(<e,e>\) function will do. There are special restrictions that will need to be imposed to capture the notion of reciprocity, including for example the distinctness condition discussed earlier. In the following sections these developments will be made and then we will return to some reciprocal examples to see how the parts fit together.

6.5 The Part Operator as a Variable Binder

Responding to criticism in Williams (1991), Heim, Lasnik and May (1991b) allow that a distributivity operator has the ability to bind variables in its scope. The intuition behind this idea, found in other work on plurals such as Roberts (1987:§4.3.2), comes from paraphrases like that in (254b) of a salient reading of (254a):

(254) a. The men outearned their wives.
    b. Each man outearned his wife.

In (254b), the pronoun bis is bound by the subject noun phrase. In (254a), the operator with universal force responsible for the distribution over men binds the pronoun their. Actually, (254a) is amenable to an alternative analysis in which the pronoun refers to the set of men, but where the synonymy with (254b) is achieved via a PPart operator (cf. section 5.4) on the transitive verb which forces distribution to man-wife pairs. For this reason, I mention (255) and (256) below since they seem less obviously amenable to the PPart analysis. In both cases, the b. sentence is meant as a paraphrase of the intended reading of the a. sentence:

(255) a. The students left the room immediately after receiving their grades.
    b. Each student left the room immediately after receiving his grade.
(256) a. Those soldiers have received money from a friend in their hometown.
b. Each of those soldiers has received money from a friend in his hometown.

Summarizing then, for the purposes of analyzing the reciprocal we will need to allow our Part operators to be variable binders. Following previous work on this topic, we find independent evidence for this modification of the semantics of distributivity operators in examples where plural pronouns are interpreted as variables whose values range over the domain of quantification of the distributivity operator.

This result should not surprise us. It amounts to saying that distributivity operators behave like quantifiers not only with respect to quantifier scope (cf. discussion of example (146) in chapter 5) and contextual domain selection but also with respect to variable binding. But does our analysis in terms of Part operators actually capture this property of distributivity? The answer to that question depends not only on the analysis of the binders, the Part operators, but also on the analysis of the bindees, the pronouns. If, for example, we merely assume that pronouns are translated as variables interpreted via an assignment function, then our Part operators will not be pronoun binders. Recall the semantics for the Part operators:

(257) Plural VP rule:
If \( \alpha \) is a singular VP with translation \( \alpha' \), then for any index \( i \), \( \text{Part}(\alpha') \) is a translation for the corresponding plural VP.

(258) Let \( \alpha \) and \( \beta \) be variables whose values are object language expressions of type \( \langle e, t \rangle \) and let \( u, v \) be variables whose values are entities in \( D' \). For all \( \alpha, \beta, x \):

\[
u \in \| \text{Part}(\beta)(\alpha) \|_{Mg} \text{ if and only if } \forall v([v \in \| \beta \|_{Mg} \land v \leq u] \rightarrow v \in \| \alpha \|_{Mg})
\]

Assume that a Part operator is attached to a VP \( \alpha \), containing the pronoun \( \text{she} \), translated as \( x_i \). Since no mention is made in (258) of alternative assignment functions, \( g(x_i) \) will be the only value for \( x_i \) that will enter into the computation, hence there will be no binding. There are two possible ways to further complete the analysis thereby allowing for binding. The first and ultimately more desirable approach would be to include an independent binding mechanism which could apply before the Partoperator. Generalizing an approach to binding found in Cooper (1979), we
might envision a setup in which NPs are moved leaving behind a numeric trace and then have a rule like the one in (259a) below, instantiated in b. and c. ("\textquotesingle \approx \approx \textquotesingle" stands for "is translated as"):  

(259)  
a. \[ [\text{XP} \ n [\text{YP} \ \alpha]] \approx \approx > \ \lambda x_5[\alpha'(x_5)] \]  
b. \[ [1 [\text{TVP} \ \text{dropped on itself}]] \approx \approx > \ \lambda x_1[\text{drop-on}'(x_1)(x_1)] \]  
c. \[ [1 [\text{VP} \ \text{hit himself}]] \approx \approx > \ \lambda x_1[\text{hit}'(x_1)(x_1)] \]  

The Part-operator (as well as the PPart operator and other generalizations) has the effect of universally quantifying into the open argument position of the predicate to which it attaches. A rule like that in (259) would effectively extend this binding to all pronouns bearing the index of the adjoined numeral. This is essentially the route that Sauerland (1994b) takes following Heim (1993).32

This approach would of course need to be justified on the basis of its utility in handling binding by noun phrases as well. Crucially, however, the binding mechanism must be divorced enough from the syntax of NPs as to allow the Part-operator to combine with a VP after the binding has occurred but before the distributed NP (the one that provides the restriction to the universal quantification) has been attached. Montague's Quantifying-In, for example, would not meet this requirement.

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32 This analysis of binding by a distributivity operator is formally similar to Carlson's (1977:269-270) analysis of the sentence \textit{cats like themselves} on a reading in which cats are claimed to be narcissistic (as opposed to an altruistic reading in which cats like cats). In this case, a modified version of Partee's (1976) rule of Derived Verb Phrase formation is followed to produce a translation in which the pronoun is bound (the superscript 'o' means that the variable ranges over objects):

\[ ^\lambda x_5.o(\text{like}'(x_5,x_5)) \]

next the VP-operator, G, applies to that translation creating a predicate of kinds:

\[ G(\ ^\lambda x_5.o(\text{like}'(x_5,x_5))) \]

This predicate is true of a kind if it is generally the case that an object realizing that kind likes itself.

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33 K.\textsuperscript{3} work\textsuperscript{3} simply to bind the D-operator within the

According to the reading of the sentence, the variable 'o' ranges over the general semantic of the Part-operator.

Now, let's apply the concept of binding to our sentence:  

\[ ^\lambda x_5.o(\text{like}'(x_5,x_5)) \]  

This predicate is true of a kind if it is generally the case that an object realizing that kind likes itself.
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Since pronominal anaphora in general is beyond the scope of this work\textsuperscript{33}, the above sketched account will not be pursued. Instead, I will simply amend the semantics of the Part and PPart operators to allow them to bind variables. The following is the amended rule for the Part operator:

\begin{equation}
\text{Plural VP rule:}
\text{If } \alpha \text{ is a singular VP with translation } \alpha', \text{ then for any indices } i,j, \text{ Part}\_j(\text{Cov}\_i)(\alpha') \text{ is a translation for the corresponding plural VP.}
\end{equation}

\begin{equation}
\text{Let } \alpha \text{ and } \beta \text{ be variables whose values are object language expressions of type } <e,t>, \text{ and let } u,v \text{ be variables whose values are entities in } D^e. \text{ For some index } j:
\end{equation}

\[
u \in \| \text{Part}_j(\beta)(\alpha) \parallel_{M,g} \text{ if and only if } \forall v[(v \in g(\beta) \land v \subseteq u) \rightarrow v \in \| \alpha \parallel_{M,g[x/\nu]}].
\]

According to the rule in (261), a Part\_i operator will bind any free x\_i in its scope. To see how this works, reconsider our original example in (262a), paraphrased on the relevant reading in (262b):

\begin{equation}
a. \text{ The men outearned their wives.}
b. \text{ Each man outearned his wife.}
\end{equation}

(262a) can now be translated along the following lines, modulo the translation of the possessive:

\begin{equation}
\text{(Part}_2(\text{Cov}_1)(\text{outearned'}(\text{the-z[wife-of}(x_2)(z)\text{]}))(\text{the-men'})
\end{equation}

Now, by taking g(\text{Cov}_1) to be the set of singularities in the domain we get the reading in (262b). The Part operator quantifies over the men and binds the variable x\_2.

Since the PPart operator is also a quantifier, it, along with other generalizations of the Part operator, is a variable binder as well. The semantics for the PPart operator is therefore modified in the same way as the Part operator was:

\text{\textsuperscript{33}Kamp and Reyle (1993) handle anaphora in distributive contexts within Discourse Representation Theory, however they do not employ a distributive operator. For a DRT account of anaphoric dependencies on the D-operator, see Roberts (1987).}
(264) Semantic Rule for PPart (with variable binding):

Let $\beta$ be a variable of type $<e,t>,t>$, $\alpha'$ an expression of type $<e,t>,t>$ and $a,b,u,v$, metavariables over elements of the domain, $D^*$, for some indices $j,k$:

$$\| \text{PPart}_{j,k}(\beta)(\alpha') \|_{M_j}^{j,a}(b) = 1 \iff \forall u \forall v [(g(\beta)(u)(v) \land u \subseteq a \land v \subseteq b) \rightarrow \| \alpha' \|_{M_k}^{j,k/u,v}(v)]$$

Evidence for binding by this operator can be produced using ditransitive verbs (or verbal complexes), as in (265):

(265) The men gave their paychecks to the women.

Imagine this is uttered in a context in which there is a salient pairing of individual men and women by marriage. In such a context, (265) might be used to assert that:

(266) Every man gave his paycheck to his wife.

This proposition is rephrased in (267) below in such a way that the role of the PPart operator becomes apparent. Here we are assuming that $g(\text{PCov}_1)$ is a set of pairs where the first is married to the second.

(267) $\forall x \forall y [ <x,y> \in g(\text{PCov}_1) \land x \text{ is a man and } y \text{ is a woman}] \rightarrow [x \text{ gave } x' \text{'s paycheck to } y]$.

Using the semantic rule in (264), (267) will have the same truth conditions as the following (again the analysis of the possessive is purely for illustration):

(268) $[\text{PPart}_{2,3}(\text{PCov}_1)(\text{give'(the-z[paycheck(x,z)])}(\text{the-women'})(\text{the-men'}))$

In this example, the second elements of the pairs quantified over by the PPart operator (roughly the agents of giving) are assigned as values of the bound variable. The pronoun is bound in effect by the second index of the operator. The operator has another binding index and evidence for this type of binding is given in the following example:

(269) The men dropped the babies on their beds.

Imagine a context in which there is a salient cover of the men and the
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babies, one in which elements of the cover are related by birth. In such a context, (270) might be used to assert that:

(270) Every man dropped his babies on their beds.

This proposition is rephrased in (271) below in such a way that the role of the PPart operator again becomes apparent. Here we are assuming that \( g(PCov_1) \) is a set of pairs where the first is the father of the second:

(271) \( \forall x \forall y [\langle x, y \rangle \in g(PCov_1) \text{ and } x \text{ is a man and } y \text{ is/are his babies}] \rightarrow [x \text{ dropped } y \text{ on } y\text{'s bed}] \)

Finally, assuming the semantic rule in (264), (271) will have the same truth conditions as the following:

(272) \([\text{PPart}_{2,3}(PCov_1)(\text{drop-on}'(x_2\text{'s bed}))(\text{the-babies'})(\text{the-men'})}\]

In this case, the first index (or ‘object index’) does the binding.

At this point we have endowed the Part operators with the ability to bind variables in their scope. This move was motivated by examples in which pronouns in the scope of a distributively understood plural verb appeared to be bound. Having made this change we now turn to other aspects of the analysis of reciprocals.

6.6 Reciprocal Pronouns

To facilitate discussion at this point, I will use representations that are intermediate between English and the translation language, such as the following:

(273) The boys\(_2\) Part\(_1\)[showed a picture of their\(_2\) creation to their\(_1\) parents].

In (273), the boys (syntactically) binds the first pronoun and the Part operator binds the second. Provided the cover variable is assigned the set containing the individual boys, (273) could be used to describe a situation where the boys created a monster together and each boy showed a picture of the monster to his parents. In contrast to the binding by the Part operator, the mechanics of the binding by the subject noun phrase has not and will not be discussed here. With intermediate representations of the kind in (273) now at our disposal, we illustrate in b. below, the current stage of our analysis of reciprocals:
(274) a. The boys saw each other.
   b. The boys \( \text{Part}_1[\text{saw EachOther}(x_i)] \).

Recall, the reciprocal is translated as a Cooper pronoun, containing a variable bound by the Part-operator. Following closely the discussion in Heim et. al (1991b) we will amend this translation by including in it other bound variables. To see why this is necessary, consider that there could be an interpretation of the representation in (274b) according to which the boys saw only girls. This would be the case if the range of the EachOther function contained just girls. To remedy this, we include another variable to be bound by the subject of the reciprocal:

(275) a. The boys saw each other.
   b. The boys_2 \( \text{Part}_1[\text{saw EachOther}(x_j)(x_i)] \).

EachOther itself is a free variable constrained as follows:

(276) for all \( M,g: \forall u \forall v \| \text{EachOther} \| M,\delta(u)(v) \subseteq u \).

What has yet to be included is the distinctness predicate that is common to accounts of the reciprocal. As it stands, (275-276) allow all the sightings to be self-sightings. To remedy this we modify (276):

(277) for all \( M,g: \forall u \forall v \exists u_0 [ \| \text{EachOther} \| M,\delta(u)(v) \subseteq u ] \).
   a. \( \forall u \forall v \exists u_0 [ \| \text{EachOther} \| M,\delta(u)(v) \subseteq u ] \).
   b. \( \forall u \forall v \exists u_0 [ \| \text{EachOther} \| M,\delta(u)(v) \supseteq u ] \).

Assuming this constraint on interpretation, the analysis of reciprocals consists of our recently amended analysis of distributivity ((260-261) and (264) above) along with the following rule of translation:

(278) for any indices, \( i,j \):
   each other_\{ij\} translates as EachOther_\{x_j\}(x_i).

EachOther is a variable of type \( \langle e, \langle e,e > \rangle \).

In keeping with the discussion in earlier parts of this chapter, this proposal, unlike most previous work in this area, has a significant pragmatic component in addition to the semantic component. The pragmatic component is realized in the form of two free variables: the cover variable of the distributivity operator and the EachOther variable of the reciprocal. In the following section, we will return to those examples that provoked...
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a more pragmatic approach to reciprocals in order to consider how the different readings come about in terms of values assigned to the free variables. The focus in the remainder of this section will be on the semantic component of the proposal.

To get a sense of what kinds of interpretations are possible for representations such as (275), repeated here:

(275) a. The boys saw each other.
    b. The boys₂ Part₁[saw EachOther(x₂)(x₁)].

I will make some assumptions about how the pragmatic parameters get filled in and then later on the various pragmatic options will be considered more carefully. To start, assume that the cells of the salient cover contains just individual boys. In this case, (275) is paraphrased as:

(279) Every boy saw a boy or boys different from himself.

If John is one of the boys, then (275) requires him to have seen a boy or boys other than himself. Which particular boy(s) John saw depends on which function EachOther denotes. If the salient cover consists of several cells corresponding to several teams, and the EachOther function returns for any team, the team that opposed it in the championship, (275) is paraphrased as:

(280) Every team saw the team that opposed it in the championship.

These paraphrases resemble the Weak Reciprocity readings discussed by Langendoen. Note in particular that the semantics of the reciprocal does not add any universal quantification of its own. In this respect, my proposal differs from its progenitors. Sauerland (1994b), following Heim, Lasnik and May (1991a,b), treats the reciprocal itself as a quantificational term which has universal force, in addition to the universal force of the distributivity operator that binds the reciprocal. To some extent, the discussion in section 6.3 above of the meanings of reciprocal sentences can be taken as an argument against this approach. Below, we return to the relevant examples, in a discussion of the pragmatics of reciprocals. But there are some additional reasons to depart from the reciprocal as quantifier approach. As the examples below show, reciprocals can appear in contexts in which universals are disallowed or are difficult to interpret. In (281), each other contrasts with universal noun phrases which appear unwieldy
when attached to only\textsuperscript{34}

(281)  
\begin{enumerate}[a.]
\item John and Mary talk only to each other.
\item ?John and Mary talk only to every student.
\end{enumerate}

When a phrase beginning with but postmodifies a quantificational term, the noun phrase position to the right of but excludes universals but not each other:\textsuperscript{35}

(282)  
\begin{enumerate}[a.]
\item Two old men grow lonely when they see noone but each other.
\item ?Two old men grow lonely when they see noone but every nurse.
\end{enumerate}

Another problem with analyzing the reciprocal as a universal was actually raised in Heim, Lasnik and May (1991b) in connection with their example (48) repeated here:

(283)  They told each other’s wives lies about each other.

The intermediate representation below is meant to illustrate the intended reading of (283) under the assumption that the cells of the most salient cover contain only singularities:

(284)  \( \text{They}_2 \text{Part}_1[\text{told each other}_{2,1} \text{'s wives lies about each other}_{2,1}] \).

The idea is that if A told B’s wife lies, then the lies were about B. On the universal interpretation of the reciprocal, (283) ends up meaning something more like the following:

(285)  Every man told every other man’s wife lies about every other man.

and Heim, Lasnik and May (1991b) need to introduce an absorption

\textsuperscript{34}For recent discussion of only attached to universals see Bonomi and Casalegno (1993) and von Stechow (1989).

\textsuperscript{35}For a recent discussion of this topic, see von Fintel (1993). He cites Hoeksema (1987a) as the first to observe the restriction I have appealed to here in order to distinguish each other from universal quantifiers.
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mechanism to get around this problem.\textsuperscript{36}

Additional arguments against a quantification analysis of the reciprocal can be found in Moltmann (1992:$\S$1.2.1).

6.7 Reciprocals in Discourse: The Pragmatics of Distributivity and Reciprocity

To this point we have considered the basic semantics of the reciprocal. To get a complete picture of the reciprocal, we also need to consider how the pragmatic variables, Cov, PCov and EachOther, get filled in. As was the case in the previous chapter, to some extent we are entering here into an area that is not properly linguistic and hence the remarks will be of a more speculative nature. What makes a relation among entities or a partition of a set of entities salient is surely answered, at least partially, as part of a general inquiry into cognitive psychology. This will make it difficult to compare the theory presented here with other attempts to analyze the reciprocals in purely semantic terms. In the absence of an explicit pragmatic theory, the semantic theories, all else being equal, are to be preferred for they make the more precise predictions. The reader will tend to favor a theory like the one proposed here to the degree that he or she is convinced it is correct to divide the problem into semantic and pragmatic components.

\textsuperscript{36}The analysis provided here gets the desired interpretation but it is not clear to me that this is always desirable. Consider the following:

(i) They put pictures of each other in each other's albums.

To the extent that I can understand (i), I think it allows that X put pictures of Y in Z's album, where $Y \equiv Z$. This suggests that the two occurrences of \textit{each other} translate into two instances of EachOther which denote different functions. If this analysis is correct, the EachOther variable would need to be indexed as well, giving rise to translations along the following lines:

(ii) $\textit{each other}_{i,j,k} \approx > \text{EachOther}_i(x_i)(x_k)$. 
6.7.1 Contextually Assigned Values for Cov and EachOther

Turning now to the theory itself, consider the simplest kind of example:

(286) \[ \text{[Jan and Mary], Part}_{ij}[\text{lifted each other}_{ij}] \]

It is generally agreed that (286) says that Jan lifted Mary and Mary lifted Jan. What does this tell us about Cov and EachOther? For simplicity, we assume that D, the domain of singularities, includes just Jan and Mary. As we know from chapter 5, in the absence of contextual clues to the contrary, there are two possible values for Cov in the interpretation of (286):

(287) a. \( g(\text{Cov}) = \{j,m\} \)

or

b. \( g(\text{Cov}) = \{\{j,m\}\} \).

Let's first consider (287a). The reading one gets for (286) now depends on the interpretation of the reciprocal. Since the first argument of the reciprocal will be the same in both cases, we only need to think about what \( g(\text{EachOther})(g(x_j)) \) could be. Let's abbreviate as follows:

(288) \( \text{eo} = g(\text{EachOther})(g(x_j)) \)

The intuitive meaning of (286) is such that:

(289) \( \text{eo}(j) = m \quad \text{eo}(m) = j \).

But nothing so far rules out the following possibility:

(290) \( \text{eo}(j) = \{j,m\} \quad \text{eo}(m) = \{j,m\} \).

For (286) this would mean that Jan lifted Jan and Mary and that Mary lifted Jan and Mary, which doesn't really seem to be a reading of (286). In fact, since it is true that if I lift Jan and myself, then I have lifted Jan, the absence of the reading of (290) is not so obvious. A clearer case would be the following:

(291) Jan and Mary connected each other's boats together.

If the reciprocal is interpreted with a function like in (290), (291) would...
mean that Jan connected his and Mary’s boats and so did Mary. Intuitively, (291) could only mean that Jan put Mary’s boat or boats together and that she did the same for him. The interpretation in (289) will give you this. There are various possibilities for explaining why (289) is possible while (290) is not. The following generalization seems a reasonable candidate:

(292) The domain and range of g(EachOther)(g(x_j)) is identical to the value assigned to Cov in the Part operator that binds the reciprocal.

If the participants in a conversation are thinking of the domain of discourse in terms of a certain partition, it seems reasonable that a function on that domain of discourse would ‘refer’ to the same partition. (292) will rule out (290) as well as other possibilities which seem equally unavailable. Consider the second interpretation for Cov, in (287b). In the absence of (292), we might have the following:

(293) eo([j,m]) = j

This would incorrectly predict that (286) could be true even if Mary was not lifted. In fact, given (292) along with the constraints on EachOther in (277) above, the second interpretation for Cov is ruled out completely.

Next we turn to one of our old farm examples:

(294) The cows and the pigs talked to each other.

Mention of the cows and the pigs induces the assignment to Cov of a partition having a bovine cell and a porcine cell. The generalization in (292) along with the semantics for EachOther yields the most salient reading of this sentence in which the cows talked to the pigs and vice versa. Two remarks are in order here. First, under the reading just described nothing is said about individual cows or pigs. In effect, we have two, ‘reciprocal’, instances of collective ‘readings’ of the kind discussed in the previous chapter (section 5.6). Presumably, there would have to have been more than one interspecies conversation going on for (294) to be true. Exactly how many more depends on the same factors that determine how many conversations are necessary for it to be true that the cows talked to the pigs. This reduction to collectives may, at least in some cases, be the source of Roberts’ (1987) ENOUGH quantifier. This view of (294), in terms of reciprocal collective action, can be extended to other more elaborate examples such as the following:
The red trays and the blue trays were stacked on top of each other.

Some speakers I consulted understood (295) to describe a situation in which there was a stack of alternating blue and red trays. One possible explanation for this would involve a particular choice for eo, which maps red objects into blue ones and vice versa. But the ‘structural’ semantics might be much simpler. If analyzed like (294), (295) amounts to the conjunction of a. and b. below:

a. The red trays were stacked on top of the blue trays.

b. The blue trays were stacked on top of the red trays.

Moreover, depending on the perspective of the speaker, either (296a) or (296b) could be used to talk about the situation just described. Thus the color alternation is preserved in the non-reciprocal, simple collectives and probably should not be analyzed as part of the semantics of the reciprocal.

The second remark on (294) has to do with the reasoning behind the generalization in (292) above. The idea is that in the simplest cases, there is a single salient partition of the domain of discourse and this is used in the interpretation of Cov and EachOther. This might provide an answer to a puzzle raised in chapter 1. There I noted that cumulativity seems to be a less general phenomenon than might at first be expected. The following inference is dubious:37

The cows talked to each other.

The pigs talked to each other.

The cows and the pigs talked to each other.

Understanding this inference as a true instance of cumulativity, means viewing the last line as case of distributivity over a reciprocal predicate, with an intermediate representation as follows:

37 I judge the inference valid if the conjunction in the conclusion is stressed. For a possible explanation, see Schwarzschild (1994:§3.2, fn. 7). Things also improve if both is used in the conclusion:

Both the cows and the pigs talked to each other.

This use of both will be discussed in the next chapter.

In order to cover a situation in which there is no obvious salient condition with respect to the two sets, we assume that we all have a corresponding cover...

In (295a) cov covers All.

I judge the inference valid if the conjunction in the conclusion is stressed. For a possible explanation, see Schwarzschild (1994:§3.2, fn. 7). Things also improve if both is used in the conclusion:

Both the cows and the pigs talked to each other.

This use of both will be discussed in the next chapter.

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(298) [The cows and the pigs]
   Part(Cov₁)[Part₁(Cov₂) [talked to each other₁₂]].

In order to get the desired but seemingly unavailable reading, g(Cov₁) must contain two cells, one bovine, the other porcine. Now, if there is a single salient cover, then g(Cov₂) must contain the same two cells. Under these conditions, the first Part operator ends up having no effect and we are back to the interpretation in which the cows talked to the pigs and vice versa. It is important to point out that all of this reasoning is under the assumption that the context is no richer than what we have in (297). Thus, we allow the possibility that a context may be rich enough to provide two covers and that speakers could juggle these.

Up to this point, we have considered cases in which the relevant cover contained two cells. In such cases, given the generalization in (292), there is only one possible candidate for the function eo. But if the cover has more cells in it, then the context is relied upon to select among several possible candidates. This is illustrated in examples from section 6.3 repeated below:

(299) a. The books in the chart below complement each other.
    b. The husbands and wives in the room are similar to each other.

In (299a), the cover is given by the squares in the chart while eo is the row-mate function: eo(x)=y iff x is in the same row as y and x ≠ y. In this case, the function is provided graphically by a chart-reading convention. In (299b), eo is the marriage function: eo(x)=y iff x is married to y. Here the source of eo is the use of the relational nouns in the subject. The examples below are variations on this idea:

(300) a. Those twins who were born before 1960 were separated from each other in school.
    b. The people who shared their summer apartments spent most of the winter arguing with each other about entry times.

(300b) differs from (299b) and (300a) in that the nature of the relations involved in the latter cases are such that for any argument x, eo(x) is necessarily a singularity (this holds for (299b), assuming there is no polygamy). In (300b), I detect a maximality effect, whereby eo(x)=y iff y is a plurality containing all and only individuals who share with x.

Summarizing so far, the context dependence argued for in section 6.3 above is now realized in the form of two free variables, one from the theory of distributivity and the other unique to reciprocals. We have just
seen cases in which the context is such as to provide values for each of these. In the simplest cases, when the relevant part of the domain of discourse contains only two pieces, the assignments become trivial, as a result of the distinctness condition. In some cases, when the two pieces are pluralities, the reciprocity itself is trivial, but it is reciprocity between collectives, with all the complexity that that entails.

6.7.2 When the Context isn’t Rich Enough

The examples in (299-300) show that the context may provide a value for the variable EachOther, but the theory as described so far would lead one to expect something stronger, namely that the context must provide such a value. But, of course, this expectation is not fulfilled. To a large extent, the literature on the semantics of reciprocals is about possible settings for Cov and EachOther precisely when the context is impoverished. In other words, like other pragmatic variables but unlike deictic pronouns, when the context is lacking, the hearer can in fact reason through to an interpretation. I do not know how exactly this reasoning works, however, below I will explore the possibility of reducing much of the calculation to a principle of charity according to which the hearer attempts to find values for the variables that will allow the utterance to be true.

Consider the following example from Fiengo & Lasnik (1973:455):

(301) The trays are stacked on top of each other.

Following the discussion of (286) above, to start with, we assume the assignments in (302) below, where p represents the tray plurality:

(302) a. g(Cov) = p
    or
 b. g(Cov) = \{p\}.

In discussing (286), we ruled out a cover like that in (302b) based on the principle in (292) and that led to a choice of an assignment like that in (302a). The difference here is that (302a) will not work either as has often pointed out in connection with this example. (301) under an interpretation with respect to g as in (302a) entails that every tray is stacked on top of some other tray or trays. This is impossible with a finite set of trays. One possible alternative to (302a) that would allow (301) to be true is the assignment of a cover in which half the trays are in one cell and half in the other. This amounts to the reciprocal collective situation we had above

with each tray from the top of one cell lying on top of a tray from the top of the other.
with example (295). And, as in that case, this would allow a single stack of trays. Another possibility involves several cells describing a situation in which there are several stacks.

The idea then is that in those cases in which the covers that have been made salient, linguistically or non-linguistically, lead to interpretations that couldn't be true, the hearer assumes other, 'more elaborate' covers that will allow the sentence to be true.

The example just studied is taken from the literature on reciprocals and it is useful at this point to compare what is generally said about these type of examples to what was said here. The reasoning attributed to the language user concerning (301) was set in motion by the fact that the relation "be on top of" is asymmetric: if a is on top b then b cannot be on top of a. This property lead to the abandonment of simple covers which resulted in a cover choice involving non-singular subplurals. This in turn lead to a collective-reciprocal interpretation in which one group of plates is collectively stacked on another. On earlier approaches the property of the main predicate, asymmetry, is more or less directly tied to a particular weak interpretation of the reciprocal. A potential advantage of the approach taken here arises when one considers an example such as:

(303) My relatives are taller than each other.

(303) seems to be infelicitous or just false, even though it might very well be true that except for my tallest relative, each of my relatives is taller than another of my relatives. In other words, we don't get the linear type of interpretation that arose with (301). Other accounts have taken this to require a further refinement of the semantics of reciprocals, one which can distinguish between the comparative relation and the "on top of" relation. For us, the asymmetry of the comparative sets in motion the same reasoning as for (301). But recall where that reasoning ends up. An intermediate cover is chosen and this leads to a collective-reciprocal interpretation. In the case of (301), this leads, somehow, to imagining a single stack of trays. To see what happens with (303), let's imagine that the default happens to contain, for example, two relatives-cells, one maternal and the other paternal. In that case, (303) would have an interpretation equivalent to the conjunction of a. and b. below:

(304)

a. My mother's relatives are taller than my father's relatives.

b. My father's relatives are taller than my mother's relatives.

Intuitively, (304a) and (304b) could not both be true and this explains why this choice for a cover will not work. Other intermediate covers will not
work as well, hence (303) has no non-contradictory interpretation. The difference between (301) and (303) has in effect been reduced to the difference between (296) and (304), a difference that has to do with collective interpretations and not with reciprocals per se.\(^{38}\)

The interpretation strategy outlined here is by no means a complete account. One intuition concerning reciprocals that is left out is the presence of a Strong Reciprocity interpretation for examples such as:

(305) My friends know each other.

The cover that includes a cell for each of my friends is salient, so I will assume for now that that is the value for Cov in a case where (305) is used to start a conversation. The interpretation now depends on what eo is. According to my intuitions, (305) could be uttered truthfully just in case there was at least one value for EachOther that made it true. But others do not agree. They take (305) to be an example that requires Strong Reciprocity: every friend must know every other friend. One explanation for this effect comes from a process of supervaluation of the kind posited by Kadmon (1990) to handle other cases of Cooper pronouns. The charitable hearer reasons herself into a position where she is faced with several alternative values for EachOther that result in different but compatible truth conditions. She assumes that the specific value for EachOther has not been made explicit because it doesn’t need to, since the facts are such that any value will make the sentence true. This would be the case on the Strong Reciprocity meaning.

The above explanation for the source of Strong Reciprocity runs counter to that of Dalrymple et al. (1994:§7). They claim that there is a meaning for (305) involving Strong Reciprocity and since it is the strongest

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\(^{38}\)The idea to relate properties of reciprocals to properties of the related non-reciprocal transitives is not new here. A difference with earlier approaches however, is that while Langendoen (1978:186), for example, would relate (i) to (ii) (schematically, (i) = (ii) \+ distinctness), the approach taken here would relate (i) to (iii), where the sum total of the plates referred to by the arguments of (iii) are the same as those referred to by the subject of (i), the subject of (ii) or the object in (ii).

(i) The plates were stacked on top of each other.
(ii) The plates were stacked on top of the plates.
(iii) These plates were stacked on top of those plates.
meaning that could be true given the meaning of the predicate containing the reciprocal and the subject of that predicate, it is the one that is chosen. This account differs from the supervaluation idea, for it is meant to be applied in all speech contexts, not just ones where eo is unspecified. Since the predicate and subject of (299a) repeated here:

(299)  a. The books in the chart below complement each other.

have the same properties as those of (305), this account predicts that the reading of the sentence discussed earlier should be unavailable since it doesn’t involve Strong Reciprocity.

I would like to end this section with what I take to be a serious problem for the analysis here proposed. Consider the following example:

(306) The monkeys were talking to each other in American English.

According to my intuition, (306) is true if some monkeys, I’m not sure how many or what fraction of them, are talking to some other monkeys. It does not require that every monkey be talking so the assignment to Cov in this example could not be a set that contained all the individual monkeys. Rather, it would have to be an intermediate cover, containing simian pluralities. The vagueness in the exact number of loquacious monkeys would then be of a kind with the vagueness present in:

(307)  a. The red monkeys were talking to the green monkeys.
    b. The monkeys were talking to Curious George.

The problem with this story is that it assumes that an intermediate cover could be assigned by some default mechanism. But such a default mechanism is not generally available. This was precisely the point of Lasersohn’s (1989) example repeated here from the previous chapter (section 5.2.3):

(308) The TAs were paid exactly $14,000 last year.

Nothing we have said about the reciprocal should lead us to think that the assignment posited for (306) is any more available than in simple distributive cases.
6.8 On the Binding of Reciprocals

Up to this point, the examples used have been restricted to those in which the sentential subject was the antecedent of the reciprocal. As is well known, the grammar of English allows other possibilities, as can be seen in the following example:

(309) The shoppers parked the cars near each other.

(309) has a reading in which each car was parked near other cars. This is not the reading one gets from the intermediate representation below:

(310) The shoppers\_4 PPart\_2\_3[parked the cars near EachOther(x\_4)(x\_3)]

According to (310), each shopper parked the cars near other shoppers. This is a possible reading of (309) but not the one we want. We are looking for distribution among the cars, not among the shoppers. This means that we need the PPart operator, not the Part-operator. In (311), I have used the PPart operator and I have altered the syntax, undoing an operation of the kind dubbed "Right-Wrap" in Bach (1979):

(311) The shoppers\_4 PPart\_2\_3[parked near EachOther(x\_4)(x\_3)] the cars\_1.

The representation in (311) yields an interpretation along the following lines:

(312) ∀x∀y[(<x,y> ∈ g(PCov), x is a shopper, y is a car) → x parked y near a car that is different from y.]

To make this more transparent, we assume that g(PCov) pairs an individual shopper with the car he owns. In that case, we get the following paraphrase for (309):

(313) Each shopper parked his car near another car.

This is the reading we are after.

In addition to the readings in (310) and (311), there is a third reading, roughly paraphrased below:

(314) Each shopper parked his car near another shopper.

On this reading (309) would be true in a situation in which John and Mary
are the two shoppers, John parked his car near Mary and Mary parked her car near John, and John and Mary are not near each other. Neither (310) nor (311) would be true in this situation. As Sauerland (1994b) has shown, this kind of reading arises with the following intermediate representation, which differs from (311) only in the indexation of the reciprocal:

(315)  The shoppers₄ PPart₂₃₄[parked near EachOther(x₄)(x₃)] the cars₁.

The representation in (315) yields an interpretation along the following lines:

(316)  ∃x∀y[⟨x,y⟩ ∈ g(PCov), x is a shopper, y is a car] → x parked y near a shopper that is different from x.

Below are examples whose most natural reading requires the same kind of indexing:

(317)  a. They dropped these pamphlets on each other's cities.
       b. Tomorrow, they will give these gifts to each other.

The possibility of rearranging the indices on (311) leads to the question of what indexations are allowed and which are banned. This topic is discussed in detail in Heim, Lasnik and May (1991a,b). For the most part, the rules governing indexation in those papers are syntactic rules, which means that the indices on the Part operators invoked here would have to be reflected in the syntactic structure, something we haven't done here. I will consider one type of invalid indexation which seems to be ruled out on semantic grounds. Consider the following permutation of (311):

(318)  The shoppers₄ PPart₂₃₄[parked near EachOther(x₄)(x₃)] the cars₁.

This leads to a reading along the following lines:

(319)  ∃x∀y[⟨x,y⟩ ∈ g(PCov), x is a shopper, y is a car] → x parked y near a shopper that is different from y.

Assuming the set of shoppers and the set of cars are disjoint, this formula is equivalent to:

(320)  ∃x∀y[⟨x,y⟩ ∈ g(PCov), x is a shopper, y is a car] → x parked y near a shopper]
This would allow that each shopper parked his car near himself and away from all other shoppers, contrary to what (309) actually says. This indicates that in addition to the other constraints on EachOther in a. and b. below, we need c. as well:

\[(321) \quad \text{for all } M, g:\]
\[a. \forall u \forall v [ \parallel \text{EachOther} \parallel_{M,g}(u) \subset u].\]
\[b. \forall u \forall v [ \parallel \text{EachOther} \parallel_{M,g}(u) \models v].\]
\[c. \forall u \forall v [ \parallel \text{EachOther} \parallel_{M,g}(u)(v) \text{ is undefined if } v \notin u] .\]

Finally, I would point out that this reliance on Part operators for the interpretation of reciprocals implies that any predicate that has a reciprocal argument must contain a Part operator. For example, the translation of the following expression:

\[(322) \quad \text{their gossip about each other}\]

would have to contain a Part operator. This fact is neither surprising nor undesirable given that we can discern distributive understandings for any predicate with a plural argument.

6.9 Concluding Remarks: Sets versus Union

In chapter 4, we considered examples used to argue that the conjunction and could not be interpreted as a union operation. The argument rested on demonstrating that truth conditional differences can arise by the replacement of an NP with another that would be coreferent on the union approach. In that chapter it was shown that certain other valid inferences fail to be predicted on the assumption that the source of the truth conditional differences was purely semantic - a matter of the referents of the NPs in question and the extensions of the VPs predicated of them. In the first part of this chapter, more evidence was given that the VPs used in chapter 4 have a discourse sensitive element to them and therefore the effects of substituting one NP for another could very well derive from differences in context change potential as opposed to reference. In the second part of this chapter, a specific analysis of reciprocals was proposed to explain the discourse effects discussed in the first part. In that analysis, there are two points of contact between the semantics and the pragmatics: the Cov variable, which is part of our account of distributivity, and the EachOther variable which is peculiar to the reciprocal.

Judging from the examples discussed here and in chapter 5, it would appear that arguments against the union theory all turn on the issue of
distributivity. Forthcoming chapters will dispel this impression, but even within the current discussion we can find counterexamples. To do so, we need to find a potential argument against the union theory that is explained on our account in terms of different values of the EachOther variable. Paralleling the data from chapter 4, such an example would involve a pair of sentences that differed in interpretation but that had identical main verb phrases as well as subjects which in other contexts would appear to be coreferent. The following story contains one such a pair.

A team of sociologists was interested in comparing relationships people have at work with those they have at home. They decided to study a group of married people, where the men worked in several groups in different factories and the women worked together in various restaurants in the city. Each person was asked to describe his or her spouse and his or her work mates. The sociologists noticed that political views were determined by the work place. In their report, they wrote that:

(323) The people who work together are similar to each other with respect to political viewpoint.

the author of this line would clearly not feel committed to the following:

(324) The husbands and wives are similar to each other with respect to political viewpoint.

One might therefore conclude that the subjects of (323-324) are non-coreferent, whereas we would say they are coreferent but that they affect the discourse differently and this has effects in the choice of value for EachOther (cf. example (299b) above).

Now imagine further that the sociologists are simultaneously studying a group of single unemployed people. One sociologist says to the other:

(325) I’ve already interviewed the people who work together and I’m waiting to meet the unemployed group.

Here the speaker would be committed to:

(326) I’ve already interviewed the husbands and wives and I’m waiting to meet the singles group.

(323-324) differ from (325-326) in that only the former contain a variable
that is susceptible to the discourse differences between the coreferent, subject NPs.