Further evidence for an HPSG-based theory of the semantics of 'different' and 'the same'

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Abstract

Yatabe (2021) presents a theory according to which the meaning of a word like *different* in a sentence like *Anna and Bill like different films* contains the meaning of a reciprocal pronoun. Since the postulated reciprocal meaning inside the meaning of a word like *different* requires the presence of a semantic antecedent, the theory entails that the apparent internal reading of a sentence like *John saw and reviewed different films*, which does not contain a plural DP that could serve as the semantic antecedent of the postulated reciprocal meaning, must be licensed in a way that is entirely different from the way in which the internal reading of a sentence like *Anna and Bill like different films* is licensed. In the present paper, I adduce additional pieces of evidence for this theory. In order to enhance the plausibility of the proposed theory, I also show how the collective interpretation of reciprocals and the interaction of reciprocals and cumulative interpretation can be accounted for within the theory.

1   Introduction

A sentence like (1) has two distinct readings, which are called the external reading and the internal reading respectively in the literature.

(1)   Anna and Bill like different films.

In the external reading, the sentence means "Anna and Bill like films that are different from the contextually salient film or films", and in the internal reading, the sentence means "The film or films that Anna likes and the film or films that Bill likes are different from each other". There is a sense in which the internal reading is licensed by the presence of the plural DP *Anna and Bill* here; the internal reading becomes unavailable when the DP is replaced with a singular DP like *Anna*. The DP whose presence licenses an internal reading of a sentence containing a word like *different* in this sense will be referred to as the *antecedent* of that word in what follows.

In Brasoveanu (2011), it is argued, convincingly in my view, that we need to distinguish two types of internal readings. The first type is exemplified by a sentence like (1), in which the antecedent of *different* is a plural noun phrase. The second type of internal reading is exemplified by the sentence, *Every student read a different book*, in which the antecedent of *different* is a singular, distributive quantifier. The same word, *different*, is used in both types of sentences in English, but as argued in Beck (2000) and Brasoveanu (2011), there are languages that use distinct words in these two types of sentences. This paper is primarily about the semantics of words that give rise to the first type of internal reading, that is, the type of internal reading that is licensed by the presence of a plural antecedent.

Yatabe (2021) presents a theory according to which one of the meanings of a word like *different* contains the meaning of a reciprocal pronoun inside it. In this theory, a sentence like (1) is associated with a semantic representation like (2) by mechanisms provided by HPSG and Minimal Recursion Semantics.

(2) $a = $ Anna $\land\ b = $ Bill
     $\land$ some$(X, X = a + b,$
         every$(y,$ member_of$(y, X),$
            some$(z,$ and(film_or_films$(z),$
                every$(w,$ other$(w, X, y),$
                   the$(v,$ film_or_films$(v) \land$ like$(w, v),$
                     different$(z, v)))),$
            like$(y, z))))$

Lines 5–7 more or less correspond to the contribution that the adjective *different* makes to the meaning of the sentence, and line 5 more or less corresponds to what I claim to be the reciprocal meaning contained in the meaning of *different*. As is standard in MRS representations, a quantifier meaning is expressed by a three-place predicate whose three arguments are the variable it binds, its restrictor, and its nuclear scope respectively. The predicate *member_of* is assumed to hold of its two arguments if and only if the denotation of the first argument is a member of the group denoted by the second argument. The predicate *other* is assumed to hold of its three arguments if and only if the denotation of the first argument is a member of the group denoted by the second argument other than the denotation of the third argument. (The symbol *and* represents conjunction that is expressed by an elementary predication whose RELN value is *and*, while the symbol "$\land$" represents conjunction that is expressed by a shared handle.) In this paper, I will refer to the analysis illustrated in (2) as the hidden-reciprocal analysis of internal readings.

According to the hidden-reciprocal analysis of internal readings, the antecedent of a word like *different* is the semantic antecedent of a reciprocal meaning, and therefore has to be a DP. The analysis is thus not applicable to the apparent internal readings of sentences like (3) and (4), which do not contain a DP that could serve as the antecedent of *different*. Accordingly, it is claimed in Yatabe (2021) that the apparent internal readings of sentences like (3) and (4) are licensed in a way that is entirely different from the way in which the internal readings of sentences like (1) are licensed. I will refer to this claim as the non-uniformity claim about apparent internal readings.

(3)   Different people discovered America and invented bifocals.

(4)   John saw and reviewed different films.

In this paper, I will present some new evidence for the hidden-reciprocal analysis of internal readings and for the non-uniformity claim about apparent internal readings. In addition, in order to enhance the plausibility of the overall theory, I will also show how the collective interpretation of reciprocals and the interaction of

reciprocals and cumulative interpretation can be accounted for within the theory. In exemplifying phenomena involving internal readings, I will mostly rely on Japanese examples because Japanese is one of the languages that make a morphological distinction between the two types of internal readings mentioned above.

2 Additional evidence for the hidden-reciprocal analysis

2.1 Distributed internal readings

First, consider the range of interpretations that a sentence like (5) can have.

(5) [Gakusei-tachi ga] [betsu-betsu no   hon o]   yonda.
     [students   NOM] [mutually different book ACC] read-PAST
     'The students read different books.'

The expression *betsu-betsu no*, which I have glossed as "mutually different", can only give rise to an internal reading, unlike the expression *betsu no*, which can give rise to an external reading as well as an internal reading, as shown in (6) and (7).

(6) Kaoru ga   betsu no hon o   yonda.
     Kaoru NOM different book ACC read-PAST
     'Kaoru read a book different from the contextually salient book.'

(7) Gakusei-tachi ga   hitori-hitori betsu no hon o   yonda.
     students   NOM each   different book ACC read-PAST
     'The students each read a book different from the books that the other students read.'

When sentence (5) is presented without any context, the most salient reading is probably one in which it means "No two of the students read the same book or books". This, however, is not the only reading the sentence has. Suppose that a group consisting of 15 students had been divided into groups of three and that each student had been told not to read the same book or books as the other two students in the same group. In such a context, (5) has a reading in which it is true if and only if each student obeyed the instruction and read a book or books different from each of the books read by the other two students in the same group. This is a reading in which the core meaning of the expression *betsu-betsu no* 'mutually different' is required to hold, in a distributed way, in each of the subgroups that together constitute the group that the sentence is talking about. I will refer to a reading like this as a distributed internal reading.

The existence of distributed internal readings is predicted by the hidden-reciprocal analysis of internal readings. In order to see how, we first need to take a look at a certain type of interpretation that can be assigned to reciprocal pronouns. Consider the sentence in (8).

(8) [Gakusei-tachi ga]   [otagai   no kaado ni] sain shita.
     [students   NOM] [each other GEN card   DAT] sign do-PAST
     'The students signed each other's cards.'

Suppose that a group consisting of 15 students had been divided into groups of three and that each student had been told to sign the cards of the two other students in the same group. In such a context, sentence (8) has a reading in which it is true if and only if each student signed the cards of the two other students in the same group. This is a reading embodying what Dalrymple et al. (1998) call Distributed Strong Reciprocity.

The theory presented in Yatabe (2021) does not take the existence of Distributed Strong Reciprocity into account, but we can easily rectify that shortcoming by modifying slightly the meaning assigned to the predicate *other*, which is used to express the meaning of reciprocals. Consider (9), which is the semantic representation assigned to sentence (8) in the theory under discussion.

(9)   the(X, students(X),
           every(y, member_of(y, X),
                every(w, other(w, X, y),
                     the(z, card_or_cards_of(z, w),
                          signed(y, z)))))

I now propose interpreting the predicate symbol *other* as a predicate that holds of its three arguments if and only if (i) the denotation of the first argument is a member of the group formed by those members of the group denoted by the second argument that are "closely related", in the contextually relevant sense, to the denotation of the third argument and (ii) the denotation of the first argument does not overlap with the denotation of the third argument. In the case at hand, each student could be viewed as "closely related" to his or her two groupmates, and the elementary predication "other(w, X, y)" could thus function as a formula that is true if and only if the denotation of w is one of the two groupmates of the denotation of y. When that interpretation is given to this elementary predication, the semantic representation expresses the Distributed Strong Reciprocity reading of the sentence, whereas the same semantic representation expresses what is called Strong Reciprocity in the literature when each student is viewed as "closely related" to all the students, rather than just to his or her two groupmates.

What I called a distributed internal reading above is the reading that results when the reciprocal meaning inside the meaning of a word like *different* is that of Distributed Strong Reciprocity. Consider, for example, the semantic representation shown in (10), which is associated with sentence (5).

(10)   the(X, students(X),
           every(y, member_of(y, X),
                some(z, and(book_or_books(z),
                     every(w, other(w, X, y),
                          the(v, book_or_books(v) $\wedge$ read(w, v),

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$$\text{different}(z, v)))),$$
$$\text{read}(y, z))))$$

Here again, the elementary predication "other(w, X, y)" could function as a formula that is true if and only if the denotation of w is one of y's two groupmates. And when that elementary predication is given that interpretation, the semantic representation expresses the distributed internal reading of the sentence.

The proposed theory makes correct predictions about the interpretation of sentences in which the antecedent of a word like *different* is a quantificational noun phrase as well. Consider (11) and (12), for example.

(11)   [Hotondo no gakusei ga]   [otagai   no kaado ni]   sain shita.
       [most   student NOM] [each other GEN card   DAT] sign do-PAST
       'Most students signed each other's cards.'

(12)   [Hotondo no gakusei ga]   [betsu-betsu no   hon o]   yonda.
       [most   student NOM] [mutually different book ACC] read-PAST
       'Most students read different books.'

Since in this theory the quantifier meaning inside the reciprocal meaning is assumed to be copied from the semantic antecedent of the reciprocal, these sentences are associated with the semantic representations shown in (13) and (14) respectively.

(13)   the(X, students(X),
         most(y, member_of(y, X),
            most(w, other(w, X, y),
               the(z, card_or_cards_of(z, w),
                  signed(y, z)))))

(14)   the(X, students(X),
         most(y, member_of(y, X),
            some(z, and(book_or_books(z),
                  most(w, other(w, X, y),
                     the(v, book_or_books(v) $\land$ read(w, v),
                        different(z, v)))),
                  read(y, z))))

The predicate *most* in line 3 of (13) is copied there from line 2, and the same predicate in line 4 of (14) is copied there from line 2.[1] Suppose that the sentences

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[1] In the theory proposed, the quantifier meaning that gets copied into the meaning of a reciprocal must be that of a distributive quantifier. It is assumed that quantifiers that are composed of numeral determiners such as *at most eight* are not distributive and that their meanings are therefore never copied into the meaning of a reciprocal. I speculate that a sentence like *At most eight books were written* is associated with a semantic representation that means "It is not the case that a book was written, with the exception of at most eight books", in which the meaning of the quantifier *at most eight books* is decomposed into negation, an existential quantifier, and a statement of exceptions. Given such an analysis, a reciprocal sentence like *At most eight students knew each other* is predicted to be associated with a semantic representation that means "It was not the case that a student knew any other student, with the exception of at most eight students".

are both talking about a group consisting of 12 students that had been divided into pairs, so that each student had one partner who was "closely related" to him or her. In such a situation, the representation in (13) is true if and only if most students signed their partner's card, assuming that an elementary predication of the form "most(x, R, S)" is true if and only if the number of possible values of x that make both R and S true is larger than the number of possible values of x that make R true but S false. This corresponds to one possible reading of sentence (11). Likewise, (14), which is true in the situation described above if and only if most students read a book or books different from the book or books their partner read, expresses a reading that sentence (12) can have in such a situation.

Thus, when combined with the natural hypothesis that the reciprocal meaning contained in the meaning of a word like *different* can express Distributed Strong Reciprocity as well as Strong Reciprocity, the hidden-reciprocal analysis of internal readings makes correct predictions about what I have called distributed internal readings.

2.2 Collective interpretation of reciprocals

In the remainder of this section, namely in subsections 2.2 and 2.3, I will discuss some inadequacies of the theory of reciprocals that I have presented so far, and will show how they can be taken care of by adding some new lexical entries to the grammar and modifying some peripheral if not minor aspects of the theory.

In the present subsection, I will discuss problems posed by the types of interpretations of reciprocals that I have been ignoring up to this point. In subsection 2.1, I only considered two kinds of interpretations that can be given to reciprocals, viz. Distributed Strong Reciprocity and Strong Reciprocity. The analysis that I have proposed deals with these two interpretations of reciprocals in a unified way. It has been noted in the previous literature, however, that reciprocals can be given some other types of interpretations as well. Some of these other types of interpretations turn out to be problematic for the proposed theory.

I will begin by examining what has been called Weak Reciprocity in the literature. Weak Reciprocity is a term that has been used in relation to the fact that reciprocals appear to be able to express an existential quantifier even when its semantic antecedent has the quantificational force of a universal quantifier. Consider the sentences in (15) and (16).

(15)   They scratched one another's backs. (from Langendoen (1978))

(16)   The children give each other a present. (from Beck (2001))

Example (15) is judged to be true if there were four people forming something like a circle and the first person scratched the second person's back, the second person scratched the third person's back, the third person scratched the fourth person's back, and the fourth person scratched the first person's back. In other words, the sentence can mean "*Every* person scratched *some* other person's back, and

every person's back has been scratched by some person", rather than "*Every* person scratched *every* other person's back". The reciprocal appears able to express an existential quantifier in sentence (16) as well. Beck (2001) says the following about this example.

> One way to do the presents is that everybody brings a present and drops it into a big bag. Later you get to close your eyes and choose a present from the bag. Alternatively, you write your name on a piece of paper, the papers go into a bag, and you have to bring a present for the person whose name you draw. In either case, [(16)] can truthfully describe the procedure because every child gives and receives a present.

In other words, this sentence can mean "*Every* child gives a present to *some* other child, and every child receives a present from some child", rather than "*Every* child gives a present to *every* other child". Both in (15) and in (16), the idea that the quantificational force of the semantic antecedent is copied into the meaning of a reciprocal does not seem to work at first blush, although it seemed to work in earlier cases, which exemplified either Strong Reciprocity or Distributed Strong Reciprocity.

Not all cases of Weak Reciprocity are problematic for the theory. For instance, the interpretation of sentence (15) is in fact correctly accounted for in the proposed theory as long as it is assumed that there are situations where only the person directly in front of you is to be regarded as "closely related" to you. Given such an assumption, the semantic representation assigned to sentence (15) in accordance with the theory presented so far can mean "Each person scratched the back of the person directly in front of him or her", and the sentence is therefore expected to be usable in the kind of situation described above. The same analysis applies to an example like (17).

(17)   Walking down Mass. Ave. from Arlington to Boston the sociologist found out: The residents on the eastern side of Mass. Ave. know each other. (from Sauerland (1998))

According to Sauerland (1998), the second sentence in (17) can be true even if every resident on the eastern side of Mass. Ave. only knows his or her neighbors. This is expected in my account because a resident's neighbors are the people who are easiest to regard as "closely related" to that resident.

The theory as it has been presented, however, cannot account for all cases of Weak Reciprocity. For example, sentence (16) does pose a problem for the account. Since the child who receives each present is not known in advance, there is no sense in which the child who ends up receiving a present is in any way "closely related" to the child who has brought that present. This means that the solution that is available in the case of sentence (15) is not available in this case and that some modification must be made to the theory.

I propose adding the following hypotheses to the theory. Reciprocal pronouns allow two distinct interpretations: non-collective interpretation, which is the one I have been discussing, and collective interpretation. Weak Reciprocity is one possible result of a reciprocal receiving collective interpretation. The two interpretations of reciprocal pronouns are each associated with a separate lexical entry, although the quantificational force of the semantic antecedent is copied into the meaning of a reciprocal irrespective of which interpretation the reciprocal receives. The meaning of a word like *different* is assumed to contain the non-collective meaning of a reciprocal; the theory of internal readings thus remains unaffected. I will flesh out these hypotheses in the remainder of this subsection.

It has been noted in the literature that reciprocal pronouns can receive collective interpretation. The sentences in (18) and (19) are some of the relevant examples.

(18)   The satellite, called Windsock, would be launched from under the wing of a B-52 bomber and fly to a 'liberation point' where the gravitational fields of the Earth, the Sun and the Moon cancel each other out. (from Dalrymple et al. (1998))

(19)   The children painted a picture of each other. (from Sauerland (1998))

In (18), the gravitational field of the Earth is supposed to cancel out the combined gravitational fields of the Sun and the Moon, and so on. Likewise, (19) has a reading in which it means that each child painted one picture showing all the other children.

It turns out that some instances of Weak Reciprocity can be regarded as cases of collective interpretation. For instance, the example in (16) above can be taken to be saying "Each child gave a present to the group consisting of all the others". This is arguably a natural account, given the kinds of situations in which the sentence can truthfully be used.

What is shown in (20) is the semantic representation that I propose to assign to sentence (19); it illustrates the way that I propose to analyze the collective interpretation of a reciprocal in general.

(20)   the(X, children(X),
　　　　　every(y, member_of(y, X),
　　　　　　　some(Z, every(w, other(w, X, y), member_of(w, Z))
　　　　　　　　　$\wedge$ every(w', member_of(w', Z), other(w', X, y)),
　　　　　　　some(u, picture_of(u, Z),
　　　　　　　　painted(y, u)))))

In a situation where each child can be viewed as "closely related" to all the children, this semantic representation means that each of the children painted a picture of the group containing all the other children and no one else. Shown in Fig. 1 is the lexical entry for *each other* that produces semantic representations like this.

Notice that the semantic representation shown in (20) still involves copying of the quantificational force of the semantic antecedent into the reciprocal meaning;
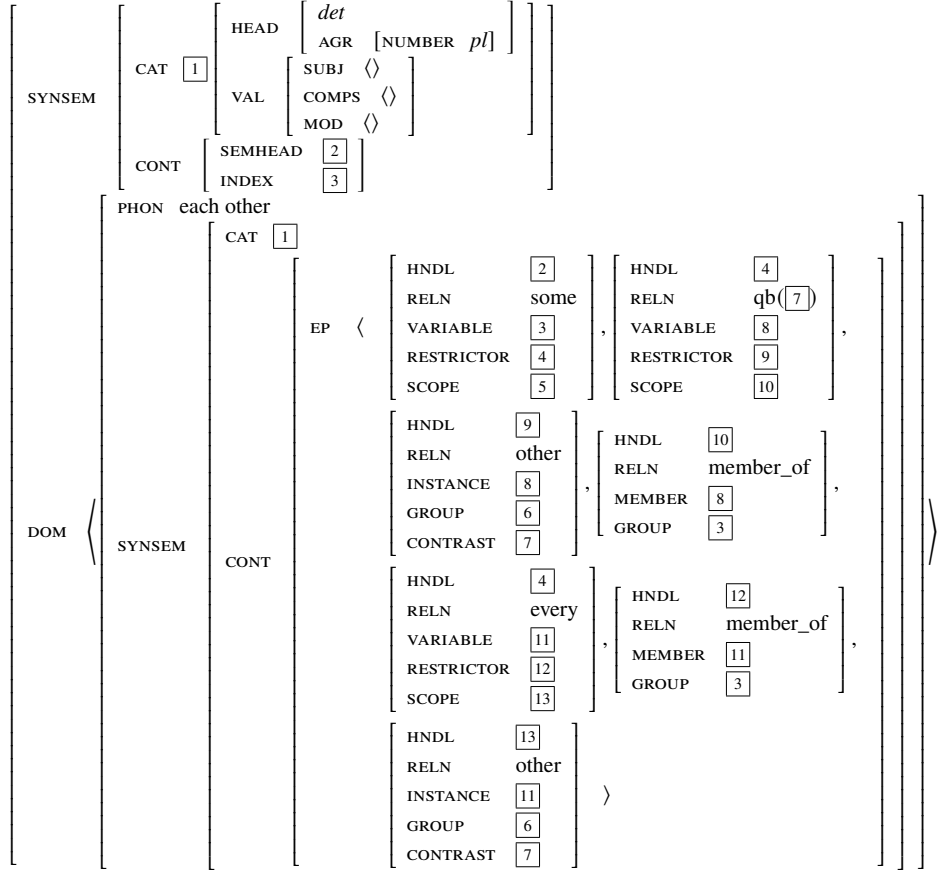
Figure 1: The lexical entry for *each other* that gives rise to collective interpretation

the predicate *every* in line 3 was copied there from line 2 on account of the *qb* function in the lexical entry in Fig. 1. (See Yatabe (2021) for the definition of the *qb* function.) This way of representing the collective interpretation receives support from the example in (21), assuming that the sentence has a reading in which it is true if and only if most children painted one picture showing most of the other children.

(21)   Most children painted a picture of each other.

The proposed account assigns to this example the semantic representation shown in (22), in which the predicate *most* in line 3 has been copied there from line 2.

(22)   the(X, children(X),
          most(y, member_of(y, X),
              some(Z, most(w, other(w, X, y), member_of(w, Z))
                      $\land$ every(w', member_of(w', Z), other(w', X, y)),
                  some(u, picture_of(u, Z),
                      painted(y, u)))))

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It is my contention that the theory that I am proposing is capable of accounting for the entire range of reciprocal interpretations except those interpretations mentioned in footnote 2 below that arguably involve idiomatization, although here I can only discuss two additional examples, namely (23) and (24).

(23)   The telephone poles are spaced five hundred feet from each other. (from Dalrymple et al. (1998))

(24)   The members of this family have inherited the shop from each other for generations. (from Beck (2001))

The sentence in (23) illustrates the type of interpretation that Dalrymple et al. (1998) call Intermediate Reciprocity, while the sentence in (24) is supposed to illustrate the interpretation that Dalrymple et al. (1998) named Inclusive Alternative Ordering.[2]

Sentence (23) can be analyzed the same way that sentence (17) is; it can be interpreted as saying that each of the telephone poles is spaced five hundred feet from its neighbor(s). Such an interpretation arises when for each telephone pole x, only the telephone poles that are closest to x are taken to be "closely related" to x.

Sentence (24) can be viewed as involving collective interpretation of a reciprocal. Specifically, the sentence can be interpreted as saying that each member of the family has inherited the shop from the collective formed by all the other family members for generations. This way of looking at (24) helps make sense of the contrast between (24) and (25), noted in Beck (2001).

(25) ??These three people inherited the shop from each other.

When only three people are involved as in (25), it is difficult to view the people as consisting of one individual and a large, stable collective from which one can inherit a shop. That difficulty can be the source of the low acceptability of (25).

To summarize the discussion in this subsection, some instances of the so-called Weak Reciprocity readings and other readings of reciprocal pronouns pose a problem for the theory of reciprocals proposed in Yatabe (2021) and subsection 2.1, but the problem can be taken care of by adding to the grammar a new lexical entry for reciprocals that gives them collective interpretation.

2.3   Interaction with cumulative interpretation

Another inadequacy of the theory of reciprocals presented in Yatabe (2021) and subsection 2.1 concerns sentences like the following, discussed in Sternefeld (1998) and Sauerland (1998).

(26)   John read the letters they wrote to each other.

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[2] Beck (2001) identifies two distinct types of Inclusive Alternative Ordering readings. Sentence (24) is an example of one of those two types, and the other type is exemplified by sentences like *The two books are lying on top of each other*, discussed by Langendoen (1978) and others. Both Langendoen (1978) and Beck (2001) adduce evidence that suggests, to my mind, that the second type is best understood as involving idiomatization of sorts.

(27)   They wrote these six letters to each other.

Both these sentences allow the antecedent of a reciprocal and another DP to jointly receive cumulative interpretation. In (27), for example, the antecedent of the reciprocal and the DP *these six letters* can receive cumulative interpretation, giving the sentence a reading in which it is true only if there are six letters such that each of those six letters was sent by one of the people to one of the others. This observation is incompatible with the theory proposed in Yatabe (2021), because in that theory the semantic antecedent of a reciprocal is taken to have the quantificational force of a distributive universal quantifier, which never gives rise to cumulative interpretation when associated with a grammatical subject position. Sentence (28), for instance, does not have a cumulative reading, i.e. a reading in which it is true if and only if every student wrote a letter or letters and there were six letters in total which were each written by a student.

(28)   Every student wrote six letters.

In order to account for the availability of cumulative interpretation in (26) and (27), below I will propose modifications to some peripheral if not minor aspects of my theory of reciprocals and delineate a novel account of cumulative interpretation that takes advantage of those modifications.

The first thing that I need to do is to modify the meaning assigned to the silent distributive operators that are assumed to be responsible for the distributive readings of sentences like *The residents wrote letters*. In Yatabe (2021), the silent distributive operators, both the one that is assumed to be adjoined to a subject-seeking expression like a VP and the one that is assumed to be adjoined to a DP, are taken to have the quantificational force of a distributive universal quantifier, causing the problem just described. The new lexical entries that I now propose to associate with the two distributive operators are shown in Fig. 2 and Fig. 3, respectively.

These lexical entries give rise to syntactic structures like (29) and (30), where the symbols "dist1" and "dist2" are used respectively to stand for the silent distributive operators given in Fig. 2 and Fig. 3.

(29)   [The residents [$_{VP}$ dist1 [$_{VP}$ wrote letters]]]

(30)   [[$_{DP}$ [$_{DP}$ The residents] dist2] [wrote letters]]

Both syntactic structures are capable of producing the semantic representation shown in (31).

(31)   the(x, residents(x),
            some(c, cover_list(c, x),
                every(x', ith_element(x', c),
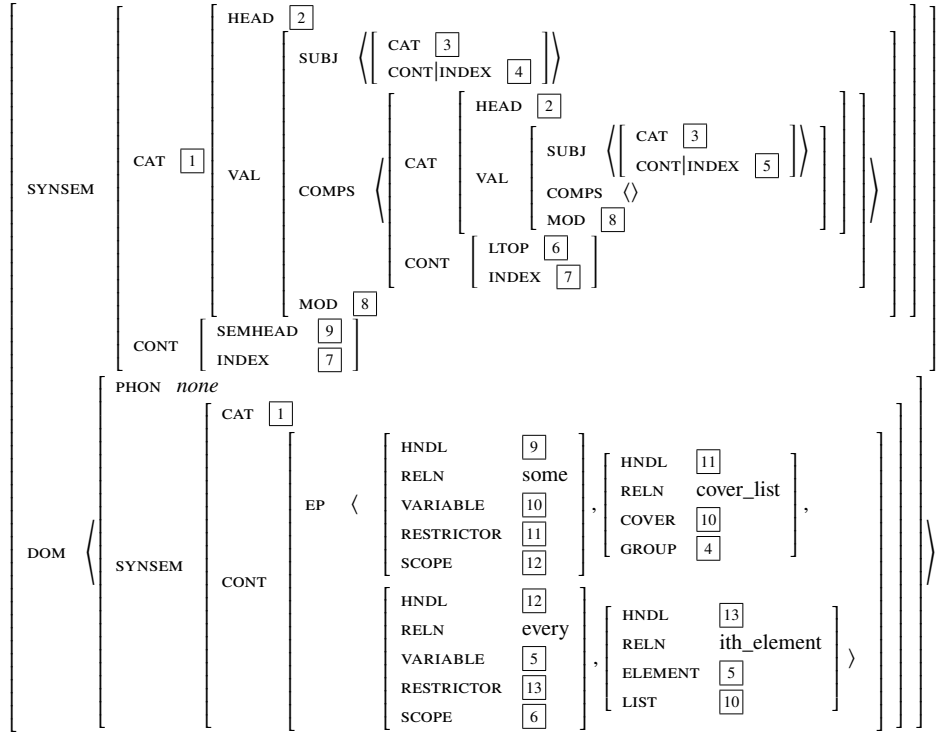   some(y, letters(y),
                        wrote(x', y)))))

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Figure 2:

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        ⎡ HEAD  [2]
        ⎢ SUBJ  ⟨[ CAT         [3]       ]⟩
        ⎢       [ CONT|INDEX    [4]       ]
        ⎢                                          ⎡ HEAD  [2]
        ⎢                              ⎡ CAT  ⎡ VAL ⎡ SUBJ  ⟨[ CAT         [3] ]⟩ ⎤ ⎤ ⎤
SYNSEM  ⎢ CAT [1]  VAL  COMPS ⟨        ⎢      ⎢     ⎢          [ CONT|INDEX  [5] ] ⎥ ⎥ ⎥     ⟩
        ⎢                              ⎢      ⎢     ⎢ COMPS ⟨⟩                     ⎥ ⎥
        ⎢                              ⎢      ⎢     ⎣ MOD   [8]                    ⎦ ⎥
        ⎢                              ⎢      ⎣                                      ⎦
        ⎢                              ⎢ CONT ⎡ LTOP   [6] ⎤
        ⎢                              ⎣      ⎣ INDEX  [7] ⎦
        ⎢       MOD  [8]
        ⎢ CONT ⎡ SEMHEAD  [9] ⎤
        ⎣      ⎣ INDEX    [7] ⎦

PHON  none
        ⎡          CAT [1]
        ⎢               ⎡ EP ⟨ ⎡ HNDL        [9]   ⎤  ⎡ HNDL   [11]        ⎤
DOM  ⟨  ⎢ SYNSEM        ⎢     ⎢ RELN        some   ⎥  ⎢ RELN   cover_list  ⎥
        ⎢               ⎢     ⎢ VARIABLE    [10]   ⎥, ⎢ COVER  [10]        ⎥,
        ⎢          CONT ⎢     ⎢ RESTRICTOR  [11]   ⎥  ⎣ GROUP  [4]         ⎦
        ⎢               ⎢     ⎣ SCOPE       [12]   ⎦
        ⎢               ⎢     ⎡ HNDL        [12]   ⎤  ⎡ HNDL    [13]         ⎤
        ⎢               ⎢     ⎢ RELN        every  ⎥  ⎢ RELN    ith_element  ⎥
        ⎢               ⎢     ⎢ VARIABLE    [5]    ⎥, ⎢ ELEMENT [5]          ⎥ ⟩
        ⎢               ⎢     ⎢ RESTRICTOR  [13]   ⎥  ⎣ LIST    [10]         ⎦
        ⎣               ⎣     ⎣ SCOPE       [6]    ⎦                           ⟩
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Figure 2: The lexical entry for a silent distributive operator that combines with subject-seeking expressions

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        ⎡ HEAD  [2]
        ⎢ SUBJ  ⟨⟩
        ⎢                                    ⎡ HEAD  [2] det
        ⎢             VAL  COMPS ⟨ ⎡ CAT ⎡ VAL ⎢ SUBJ  ⟨⟩ ⎤ ⎤ ⟩
SYNSEM  ⎢ CAT [1]                 ⎢      ⎢     ⎢ COMPS ⟨⟩ ⎥
        ⎢                         ⎢      ⎣     ⎣ MOD   ⟨⟩ ⎦
        ⎢                         ⎣ CONT [ INDEX  [3] ]
        ⎢             MOD  ⟨⟩
        ⎢ CONT ⎡ SEMHEAD  [4] ⎤
        ⎣      ⎣ INDEX    [5] ⎦

PHON  none
        ⎡          CAT [1]
        ⎢               ⎡ EP ⟨ ⎡ HNDL        [4]   ⎤  ⎡ HNDL   [7]         ⎤
DOM  ⟨  ⎢ SYNSEM        ⎢     ⎢ RELN        some   ⎥  ⎢ RELN   cover_list  ⎥
        ⎢               ⎢     ⎢ VARIABLE    [6]    ⎥, ⎢ COVER  [6]         ⎥,
        ⎢          CONT ⎢     ⎢ RESTRICTOR  [7]    ⎥  ⎣ GROUP  [3]         ⎦
        ⎢               ⎢     ⎣ SCOPE       [8]    ⎦
        ⎢               ⎢     ⎡ HNDL        [8]    ⎤  ⎡ HNDL    [9]          ⎤
        ⎢               ⎢     ⎢ RELN        every  ⎥  ⎢ RELN    ith_element  ⎥
        ⎢               ⎢     ⎢ VARIABLE    [5]    ⎥, ⎢ ELEMENT [5]          ⎥ ⟩
        ⎢               ⎢     ⎢ RESTRICTOR  [9]    ⎥  ⎣ LIST    [6]          ⎦
        ⎣               ⎣     ⎣ SCOPE       [10]   ⎦                           ⟩
```
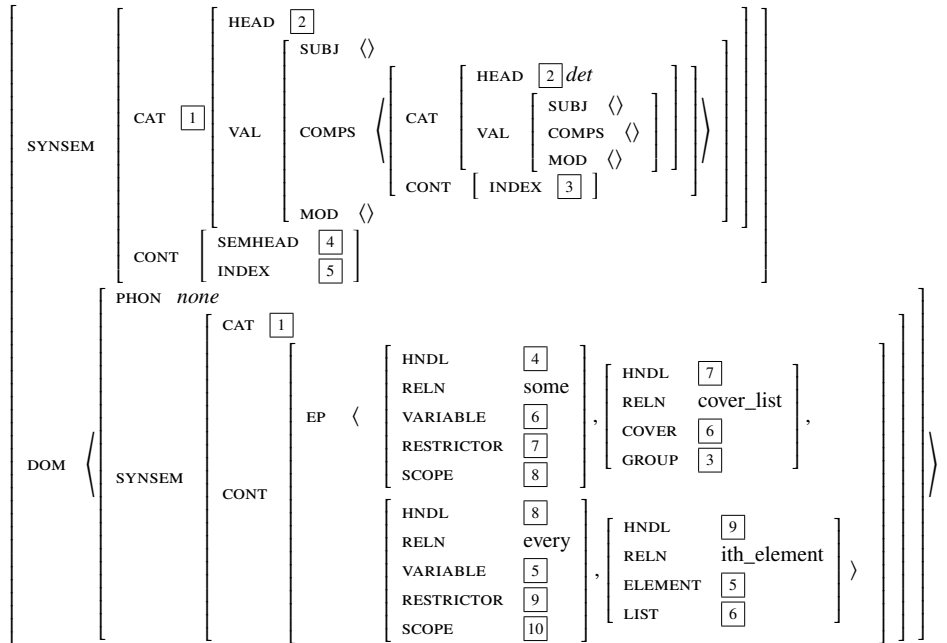
Figure 3: The lexical entry for a silent distributive operator that combines with DPs

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The predicate symbol *cover_list*, used in (31), is given the interpretation defined in (32).

(32)   A formula of the form "cover_list(x, y)" is true if and only if the denotation of x is a cover list of the denotation of y. We say that a list C is a *cover list* of an entity E if and only if the sum of all the elements of C amounts to E.

A cover list is so called because it is similar to what is called a cover in the literature (see Schwarzschild (1996, Chapter 5) and the references cited there) but is a list rather than a set. One possible cover list of a group consisting of three books, say Book1, Book2, and Book3, is a list whose first element is Book1 and whose second element is Book2 + Book3, i.e. the group consisting of Book2 and Book3.

The predicate symbol *ith_element*, also used in (31), is to be interpreted according to the definition in (33).

(33)   Definition of the interpretation of the predicate symbol *ith_element*:
        Suppose that one or more elementary predications of the form "ith_element(_, _)" are labeled by the same handle and that no other elementary predication is labeled by that handle. Then the denotation of those elementary predications, i.e. "ith_element(a_1, b_1) $\land \cdots \land$ ith_element(a_n, b_n)" (where $n \geq 1$), is defined only if there is an integer m larger than 1 such that $b_1, \ldots, b_n$ are each a list of length m. Provided it is defined, the denotation is 1 if there is an integer i ($1 \leq i \leq m$) such that, for each j ($1 \leq j \leq n$), a_j is the ith element of b_j, and is 0 otherwise.

Let me illustrate the consequences of these definitions using the sentence *The residents wrote letters* as an example. Suppose the DP *the residents* refer to three people, Amy, Bill, and Chris. One possible cover list for the denotation of this DP is, then, the list <Amy + Bill, Chris>, where "Amy + Bill" is meant to be the sum of Amy and Bill. When the variable c denotes that cover list, the formula "ith_element(x', c)" denotes 1 if and only if x' denotes either Amy + Bill or Chris. Thus, the semantic representation shown in (31) above can be true if Amy and Bill jointly wrote some letters and Chris wrote some letters too.

I am now in a position to present my account of cumulative readings. In the account that I propose, cumulative interpretation is generated when quantificational elementary predications coming from two or more silent distributive operators are merged with each other by the rule given in (34), which is one of the rules that Yatabe and Tam (2021) propose in order to assign appropriate truth conditions to sentences such as *Every woman is smiling and every man is frowning who came in together*, discussed in Fox and Johnson (2016). (What is given in (34) is the version of the rule presented in Yatabe (2021), which is different from the original version only in minor respects.)

(34)   MRS Adjustment Rule 2:
        Suppose that a given MRS representation contains n elementary predications of the following form, that these n elementary predications appear in

this order in the MRS representation, and that there is no other elementary predication in the representation that shares the same RESTRICTOR value and the same SCOPE value with these n elementary predications.

$$\begin{bmatrix} \text{HNDL} & \boxed{h_1} \\ \text{RELN} & \boxed{1} \\ \text{VAR} & \boxed{v_1} \\ \text{RESTRICTOR} & \boxed{2} \\ \text{SCOPE} & \boxed{3} \end{bmatrix}, \cdots, \begin{bmatrix} \text{HNDL} & \boxed{h_n} \\ \text{RELN} & \boxed{1} \\ \text{VAR} & \boxed{v_n} \\ \text{RESTRICTOR} & \boxed{2} \\ \text{SCOPE} & \boxed{3} \end{bmatrix}$$

Then these n elementary predications can be replaced by a single elementary predication of the following form, if $\boxed{h_1}$, ..., $\boxed{h_n}$ are known to be identical with each other and $\boxed{v_1}$, ..., $\boxed{v_n}$ are distinct from each other.

$$\begin{bmatrix} \text{HNDL} & \boxed{h_1} \\ \text{RELN} & \boxed{1} \\ \text{VAR} & \boxed{v_1 + \cdots + v_n} \\ \text{RESTRICTOR} & \boxed{2} \\ \text{SCOPE} & \boxed{3} \end{bmatrix}$$

The newly created elementary predication is to be placed at the position where the leftmost of the deleted elementary predications was located, and is to be interpreted in the expected way. For instance, when the denotation of $\boxed{1}$ is "every", the resultant elementary predication is interpreted as saying "Every n-tuple that makes the restrictor true makes the nuclear scope true as well".

I will use sentence (35) to illustrate the workings of the proposed account.

(35) The residents wrote four letters.

(36) [[The residents] [dist1 [wrote [[four letters] dist2]]]]

The sentence can have the syntactic structure shown in (36), and the two quantificational elementary predications that come from *dist1* and the two quantificational elementary predications that come from *dist2* can be merged pairwise with each other by the MRS Adjustment Rule 2. The resulting semantic representation will look like (37).

(37) the(x, residents(x),
      some(y, four(y) $\wedge$ letters(y),
          some($c+d$, cover_list(c, x) $\wedge$ cover_list(d, y),
              every($x'+y'$, ith_element(x', c) $\wedge$ ith_element(y', d),
                 wrote(x', y'))))))

We can associate with the subject DP the cover list <Amy + Bill, Chris>, and with the object DP the cover list <letter1, letter2 + letter3 + letter4>. When the variables

c and *d* are assigned these two cover lists as their values respectively, the formula "ith_element(x', c) $\wedge$ ith_element(y', d)" denotes 1 if and only if either x' denotes Amy + Bill and y' denotes letter1 or x' denotes Chris and y' denotes letter2 + letter3 + letter4. Therefore the sentence is predicted to be true if Amy and Bill jointly wrote one letter and Chris wrote three letters. The proposed theory thus accounts for the availability of the cumulative reading of sentence (35).

In order for the semantic representation in (37) to express adequate truth conditions, it needs to be assumed that the denotation of a formula of the form "every(x, P, Q)" is undefined when the denotation of the second argument, P, is undefined. In conjunction with the stipulation (stated in (33)) that the denotation of a formula of the form "ith_element(a_1, b_1) $\wedge \cdots \wedge$ ith_element(a_n, b_n)" is undefined unless $b_1, \ldots, b_n$ are lists of the same length, this assumption ensures that (37) is true if and only if the cumulative reading of the sentence is true.

The proposed account of cumulative interpretation is arguably capable of dealing with sentences in which DPs like *at most eight books* contribute to cumulative interpretation, as long as it is assumed (i) that, as proposed in footnote 1, the meaning of such a DP is decomposed into negation, an existential quantifier, and a statement of exceptions and (ii) that negations that come from two or more such DPs can be merged into one. It would then be possible to interpret a sentence like *Exactly two residents wrote exactly four letters* as meaning "It is not the case that a resident wrote a letter, with the exception of exactly two residents and exactly four letters".

Let us now see how we can deal with sentences like (26) and (27). I will focus on sentence (27). This sentence can have a syntactic structure like (38), where the subject and the reciprocal each combine with *dist2* once and the DP *these six letters* combines with *dist2* twice.

(38) [[They dist2] [wrote [[[these six letters] dist2] dist2] to [[each other] dist2]]]

Given the account of cumulative interpretation proposed here and given the account of the collective interpretation of reciprocals proposed in Sect. 2.2, this syntactic structure can be associated with the semantic representation shown in Fig. 4. The formula "$x \rightarrow j + b + t$" on line 1 means that $j + b + t$ (which could denote John, Bill, and Tom) has been selected as the antecedent of *they* (see Yatabe (2022)). Lines 3 and 4 express the cumulative interpretation of *they* and *these six letters*. Lines 5 and 6 express the collective interpretation of *each other*. And lines 7 and 8 express the cumulative interpretation of *these six letters* and *each other*.

This semantic representation is true in a situation where each of the three people referred to by the subject DP sent the other two people a letter each. Let us refer to the three people being talked about as John, Bill, and Tom, and to the six letters being talked about as Letter1, ..., Letter6. The values of the variables *c* and *d*, which are meant to denote cover lists, can be <John, Bill, Tom> and <Letter1 + Letter2, Letter3 + Letter4, Letter5 + Letter6>, respectively. When the values of the variables x' and y' are John and Letter1 + Letter2 respectively, the value of *z* will

$$some(x, x \rightarrow j + b + t,$$
$$some(y, these(y) \land six(y) \land letters(y),$$
$$some(c + d, cover\_list(c, x) \land cover\_list(d, y),$$
$$every(x' + y', ith\_element(x', c) \land ith\_element(y', d),$$
$$some(z, every(w, other(w, x, x'), member\_of(w, z))$$
$$\land every(w', member\_of(w', z), other(w', x, x')),$$
$$some(e + f, cover\_list(e, y') \land cover\_list(f, z),$$
$$every(y'' + z', ith\_element(y'', e) \land ith\_element(z', f),$$
$$wrote(x', y'', z')))))))))$$

Figure 4: A semantic representation that can be assigned to (38)

be Bill + Tom, the values of e and f can be <Letter1, Letter2> and <Bill, Tom> respectively, and the last two lines of the representation can therefore mean "John wrote Letter1 to Bill and Letter2 to Tom". What happens when the value of x' is either Bill or Tom is analogous.

Incidentally, the modifications that have been proposed in this subsection allow the theory to assign adequate truth conditions to sentences like (39).

(39)   They released one another.

As noted in Langendoen (1978), sentence (39) can be true when there were three prisoners A, B, and C, A and B jointly released C, and then C released A and B. In the theory proposed, this reading can be obtained by associating with the subject DP a cover list of the form <A + B, C>.

There is one problem that I have been ignoring so far. The problem is that the semantic representation in Fig. 4 in fact violates the condition on the relationship between the second and the third argument of the predicate *other* formulated in Yatabe (2021) (stated in (44) of that paper). I thus propose that that constraint be replaced with the constraint given in (41).[3] The term *source variable*, used in (41), is defined in (40).[4]

(40)   Definition of *source variable*:
        A variable x is a *source variable* of a variable y if and only if
        (a) x and y are the same variable, or
        (b) y is bound by a quantifier whose restrictor is of the form "member_of(y, x)", or
        (c)   there is a variable c such that (i) y is bound by a quantifier in whose restrictor a formula of the form "ith_element(y, c)" is conjoined with zero or more other formulas and (ii) c is bound by a quantifier in

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[3]Unlike the condition stated in (44) of Yatabe (2021), the condition stated in (41) here does not take into account examples like *Tom shouted and Mary cried each other's names*, discussed in Chaves (2014).

[4]Clause (d) is necessary in dealing with cases involving *respectively* interpretation. See Yatabe (2022) for discussion.

whose restrictor a formula of the form "cover_list(c, x)" is conjoined with zero or more other formulas, or

   (d) y is bound by a quantifier whose restrictor is of the form "$y = x$", or

   (e) x is a source variable of a variable that is a source variable of y.

(41)   In each elementary predication whose RELN value is *other*, the GROUP value (i.e. the second argument in the linear notation) must be a source variable of, but must not be the same variable as, the CONTRAST value (i.e. the third argument in the linear notation).

3   Evidence for the non-uniformity claim

The hidden-reciprocal analysis of internal readings is not applicable to sentences like (3) and (4), which do not contain a DP that could serve as the antecedent of *different*. The analysis thus entails that the grammatical mechanism that gives rise to the apparent internal readings of these sentences is different from the mechanism that gives rise to the internal readings of sentences like (1). In Yatabe (2021), the apparent internal readings of (3) and (4) are accounted for by hypothesizing (i) that (3) involves left-node raising (LNR) of *different people* out of two clauses, (ii) that (4) involves right-node raising (RNR) of *different films* out of two VPs, and (iii) that the word *different* in these sentences denotes a one-place predicate that is satisfied if and only if (a) its sole argument has a referential equivalent of the form $x_1 + \cdots + x_n$, where $n > 1$, and (b) for each i and j such that $1 \le i \le n$, $1 \le j \le n$, and $i \ne j$, the denotation of x_i and the denotation of x_j are different from each other.[5] The term *referential equivalent*, which I have just used, is defined as follows (see Yatabe (2022)).

(42)   Definition of *referential equivalent*:
A variable x is a *referential equivalent* of a variable y if and only if (i) x and y are the same variable, or (ii) x is bound by a quantifier whose restrictor is of the form "$x \rightarrow y$" or of the form "$x = y$", or (iii) y is bound by a quantifier whose restrictor is of the form "$y \rightarrow x$" or of the form "$y = x$", or (iv) x is a referential equivalent of some variable that is a referential equivalent of y.

The details of this account are as follows. In the theory of RNR and LNR defended in Yatabe and Tam (2021), a right- or left-node-raised expression may be given a composite index (i.e. an index of the form $x_1 + \cdots + x_n$) whose components (i.e. $x_1, \ldots, x_n$) are the indices that the expression is given before application of right- or left-node raising. As a result, sentence (3) can be associated with a semantic representation that means "for some $x + y$ such that $x + y$ are different people, x discovered America and y invented bifocals", if *different people* is taken to have been left-node-raised. Likewise, sentence (4) can be associated with a

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[5]Hypothesis (iii) is hinted at but not articulated in Yatabe (2021).

semantic representation that means "for some $x + y$ such that $x + y$ are different films, John saw x and reviewed y", if *different films* is taken to have been right-node-raised. The grammatical mechanism that licenses this interpretation is the same mechanism that licenses the most salient interpretation of the example in (43), discussed in Abbott (1976).

(43)   I borrowed, and my sister stole, a total of $3000 from the bank.

The example in (44) below, discussed in Kubota and Levine (2016) and Kubota and Levine (2020), could be taken to be circumstantial evidence for such an account, because the acceptability of a sentence like this is expected in a theory based on the view that the apparent internal readings of the sentences under discussion are resulting from LNR and RNR, but unexpected in other theories, such as Kubota and Levine's, according to which apparent internal readings are always licensed by the presence of some sort of conjunction or plurality in the same sentence.

(44)   John defeated, whereas/although Mary lost to, the exact same opponent.

Example (44) involves RNR out of non-coordinate structure, and the account described above is the only currently available account of the apparent internal reading that this sentence has. The theory advocated in Kubota and Levine (2016) and Kubota and Levine (2020) does not contain a mechanism that licenses non-coordinate RNR, and is therefore incapable of handling the apparent internal reading of a sentence like this.

Kubota and Levine, however, say the following about examples like (44).

> We think that the relevant generalization is whether the construction in question has the meaning of conjunction. *Whereas* and *although* are truth-conditionally equivalent to conjunction, with an extra pragmatic function of indicating a particular discourse relation (some kind of contrast) between the two clauses. Since the analysis we present below is predicated of the conjunctive meaning of *and* rather than its syntactic coordinatehood, the examples in [(44)], rather than undermining our analysis, in fact provide further corroboration for it. (Kubota and Levine (2020, p. 123))

I take them to be saying here something like the following: if a sentence like (44) is possible only when the syntactic structure involved has conjunctive meaning, then the semantic part of their theory can be kept intact, and it might even be the case that a non-coordinate syntactic structure that has conjunctive meaning can be treated, on some temporary basis, as a type of coordinate structure, allowing the syntactic part of their theory to be kept intact as well. In other words, I interpret the authors as saying, in effect, that non-coordinate RNR and LNR are coordinate RNR and LNR in disguise.

There is a reason to believe that non-coordinate RNR and LNR cannot be explained away as coordinate RNR and LNR in disguise. Consider sentence (45).

(45) [Onaji apaato   no betsu-betsu no   heya ni], Tanaka san
    [same apartment building GEN mutually different room DAT] Tanaka san
    ga   hikkoshite kita   no to onaji hi ni Yamada san mo
    NOM move-GER come-PAST NML with same day DAT Yamada san also
    hikkoshite kita   no desu.
    move-GER come-PAST NML be.POL.PRES
    'Yamada san also moved into, on the same day that Tanaka san moved into,
    different units in the same apartment building.'

This sentence shows that an example like (44) is possible even when the syntactic structure involved does not have conjunctive meaning (at least in Japanese). Sentence (45) involves non-coordinate LNR of the dative noun phrase *onaji apaato no betsu-betsu no heya ni* out of an adjunct clause and out of the clause modified by that adjunct clause. The meaning expressed by the adjunct clause is non-conjunctive, unlike that expressed by the adjunct clause in (44). The adjunct clause in (45) means that the event denoted by the main clause took place on a certain day, and that temporal meaning is clearly part of the truth conditions of the sentence, not any kind of implicature.

A similar example can be constructed in English as well, as shown in (46), an example that I owe to Steve Wechsler (personal communication).

(46) Chris moved into, on the same day that Pat moved out of, the same apartment building, but different units.

These observations are consistent with the theory proposed in Yatabe (2021), which incorporates the non-uniformity claim about apparent internal readings, and are problematic for theories like those proposed in Carlson (1987), Barker (2007), and Kubota and Levine (2020), in which the presence of coordination or plurality is taken to be the source of all apparent internal readings.

4   Concluding remarks

In summary, I have shown the following two things. First, the hypothesis that the reciprocal meaning contained inside the meaning of a word like *different* can be that of Distributed Strong Reciprocity as well as that of Strong Reciprocity serves to expand the empirical coverage of the hidden-reciprocal analysis of internal readings, arguably boosting the plausibility of that analysis. And second, cases of apparent internal readings involving non-coordinate RNR or LNR indicate that not all apparent internal readings involve coordination or plurality, lending support to the non-uniformity claim about apparent internal readings. In order to enhance the credibility of the overall theory, I have also shown how the collective interpretation of reciprocals and the interaction of reciprocals and cumulative interpretation can be accounted for within the theory.

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