

## Reciprocity without reciprocal pronouns\*

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**Abstract** In this paper, I claim that reciprocity consists of three independent semantic components, namely (i) the distributivity component, (ii) the anaphoricity component and (iii) the disjointness component. I show that a distributor *sorezore* in Japanese induces a reciprocal reading when the configuration between *sorezore* and its antecedent violates Condition B. Adopting the plural dynamic semantic framework (van den Berg 1996; Nouwen 2007; Brasoveanu 2007: among others), I propose that the co-reference condition of *sorezore* is collectively evaluated, but its scope domain is distributively evaluated. As a result, *sorezore* and its antecedent are co-referential at the level of plural individuals, but disjoint at the level of atomic individuals, deriving a reciprocal reading. This suggests that the disjointness condition is not hard-wired in the semantics of *sorezore*. I further discuss other reciprocal strategies in Japanese and in other languages, and suggest that distributivity and anaphoricity are not always encoded to a single entry, either.

**Keywords:** reciprocals, distributivity, dynamic plural logic, disjointness condition

### 1 Introduction

In this paper, I propose that the semantics of reciprocity can be decomposed into three separate components, namely (i) the distributivity component, (ii) the anaphoricity component and (iii) the disjointness component, and claim that these components are not always realised as a single lexical item. To support this claim, I discuss properties of the distributor *sorezore* in Japanese when it occurs in its bare form. The main point of the discussion is that reciprocity is not inherent to *sorezore* and thus it is not desirable to assign it the semantics of reciprocal pronouns. Rather, the distribution of reciprocal readings suggests that the disjointness condition comes from Condition B. I propose that distributive evaluation of Condition B offers the disjointness effect only when it is necessary. In this approach, *sorezore* collectively evaluates the co-reference condition, but distributively evaluates a lexical relation. I further investigate two other reciprocal strategies in Japanese, namely *otagai* and *-au*, and propose

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that *otagai* encodes the distributivity component and the anaphoricity component, whereas *-au* only encodes the distributivity component. This type of variation can also be found in other languages, suggesting that this three-way decomposition approach sheds light on cross-linguistic variation of reciprocal strategies.

The rest of this paper is organised as follows. §2 discusses the distribution of reciprocal readings of *sorezore* and suggests that reciprocity is not inherent to *sorezore*. §3 introduces the Plural Compositional Discourse Representation Theory (Brasoveanu 2008: *et seq*), which I adopt in this paper. In §4, I propose that reciprocal readings of *sorezore* are derived as a result of distributive evaluation of Condition B. §5 discusses lack of reciprocal readings with pronouns. Lastly, §6 discusses other reciprocal strategies in Japanese and some other languages to provide further support for the three-way decomposition of reciprocity.

## 2 Non-inherent reciprocity with *sorezore*

In this section, I introduce the core empirical generalisation concerning *sorezore* with respect to the distribution of reciprocal readings. First of all, *sorezore* functions as an overt distributor as shown in (1).

- (1) a. Karera-ga kaban-o **sorezore** (san-ko) hakon-da.  
       they-NOM suitcase-ACC DIST (3-CL) carry-PAST  
       ‘‘They each carried (three) suitcases.’’  
       b. **Sorezore**-no toosyu-ga huta-tsu-no kyuusyu-o oboe-ta.  
       DIST-GEN pitcher-NOM 2-CL-GEN pitch type-ACC acquire-PAST  
       ‘‘Each pitcher acquired two types of breaking balls.’’

*Sorezore* can also occur as an argument in its bare form. In such cases, it behaves as a pronominal element. When it is an argument and takes a clause-internal antecedent, it induces a reciprocal reading as shown in (2).<sup>1,2,3</sup>

- (2) San-nin-no koohosya<sup>u<sub>1</sub></sup>-ga **sorezore**<sub>u<sub>1</sub></sub>-o hihan-sita.  
       3-CL-GEN candidate-NOM DIST-ACC criticise-PAST  
       ‘‘The three candidates criticised each other.’’

1 Some native speakers of Japanese found the reciprocal reading is not obligatory in (2), but they agreed that the reciprocal reading is strongly preferred. I leave this issue of preference for later work.

2 I notate a discourse referent by using *u* with a numerical subscript. The superscript *u<sub>n</sub>* indicates that an expression introduces *u<sub>n</sub>* and the subscript *u<sub>n</sub>* indicates that an expression is co-indexed with *u<sub>n</sub>*.

3 Japanese does not have an obligatory plural morpheme, e.g., cardinal modification does not require a plural morpheme. Throughout this paper, I assume that common noun denotations in Japanese include both atomic individuals and plural individuals (Chierchia 1998: among others).

In (2), *sorezore* only has a reciprocal reading: it is true under the reciprocal scenario (3a), but false under the reflexive scenario (3b) or the mixed scenario (3c).

- (3) Ann, Belle and Chris are nominated as candidates of the president of a student union. They participate a pre-election debate.
- a. **Reciprocal:** Ann criticised Belle and/or Chris, Belle criticised Ann and/or Chris, and Chris criticised Ann and/or Belle.  $\Rightarrow$  (2) is **true**
  - b. **Reflexive:** They are not keen for the election. Ann criticised herself, Belle criticised herself, and Chris criticised himself.  $\Rightarrow$  (2) is **false**
  - c. **Mixed:** While Ann and Belle are keen for the election, Chris is not. Ann criticised Belle and Belle criticised Ann. Chris only criticised himself.  $\Rightarrow$  (2) is **false**

*Sorezore* can also occur as a possessive pronoun as shown in (4).<sup>4</sup>

- (4) Dezainaa-tachi<sup>u1</sup>-ga **sorezore**<sub>u1</sub>-no huta-tu-no an'-o hihan-sita.  
 designer-PL-NOM DIST-GEN 2-CL-GEN plan-ACC criticise-PAST  
 “The designers criticised their two plans.”

In (4), *sorezore* does not only have a reciprocal reading, but it has a weak truth condition which subsumes a reflexive reading, a reciprocal reading and a mixed reading. (5) shows that (4) can be true under the reciprocal scenario (5a), the reflexive scenario (5b) or the mixed scenario (5c).

- (5) Ann, Belle and Chris each proposed two design plans for their new product.
- a. **Reciprocal:** Ann criticised Belle’s and/or Chris’, Belle criticised Ann’s and/or Chris’ and Chris criticised Ann’s and/or Belle’s.  $\Rightarrow$  (4) is **true**
  - b. **Reflexive:** Because of insecurity, they each criticised their own plans.  $\Rightarrow$  (4) is **true**
  - c. **Mixed:** Their plans are all controversial. Ann criticised Belle’s and Belle criticised Ann’s. Chris only criticised his own plans.  $\Rightarrow$  (4) is **true**

This contrast between the truth condition of (2) and the truth condition of (4) suggests that reciprocity is not inherent to *sorezore*.

Similarly, *sorezore* has a weak truth condition when it occurs as an argument and takes a clause-external antecedent. In (6), *sorezore* occurs as the object of the embedded clause and takes the matrix subject as its antecedent.

<sup>4</sup> I put a cardinal modifier between *sorezore* and the possessee. Otherwise, *sorezore* at the prenominal position is ambiguous between the distributive quantifier use and the possessive anaphoric use.

- (6) Gakusya-tachi<sup>u1</sup>-wa [guuguru<sup>u2</sup>-ga **sorezore**<sub>u1</sub>-o manei-ta to] it-ta.  
 scholar-PL-TOP [google-NOM DIST-ACC invite-PAST that] say-PAST  
 “The scholars said that Google invited them.”

(6) can be true under any of the three scenarios in (7).

- (7) David, Elin and Fran were invited to a workshop on artificial intelligence.
- a. **Reciprocal**: David said that Google invited Elin and/or Fran, Elin said that Google invited David and/or Fran and Fran said that Google invited David and/or Elin.  $\Rightarrow$  (6) is **true**
  - b. **Reflexive**: David said that Google invited him (i.e. David), Elin said that Google invited her (i.e. Elin) and Fran said that Google invited her (i.e. Fran).  $\Rightarrow$  (6) is **true**
  - c. **Mixed**: David said that Google invited Elin, Elin said that Google invited David and Fran said that Google invited her (i.e. Fran).  $\Rightarrow$  (6) is **true**

In (8), *sorezore* occurs as a possessor of the embedded object and takes the matrix subject as its antecedent.

- (8) Gakusya-tachi<sup>u1</sup>-wa [guuguru<sup>u2</sup>-ga **sorezore**<sub>u1</sub>-no huta-tu-no ronbun-o  
 scholar-PL-TOP [google-NOM DIST-GEN 2-CL-GEN paper-ACC  
 in’yoo-sita to] it-ta.  
 cite-PAST that] say-PAST  
 “The scholars said that Google cited their two papers.”

Again, (8) can be true under any of the three scenarios in (9).

- (9) David, Elin and Fran have two recent publications this year.
- a. **Reciprocal**: David said that Google cited Elin’s and/or Fran’s, Elin said that Google cited David’s and/or Fran’s and Fran said that Google cited David’s and/or Elin’s.  $\Rightarrow$  (8) is **true**
  - b. **Reflexive**: David said that Google cited his (i.e. David’s), Elin said that Google cited hers (i.e. Elin’s) and Fran said that Google cited hers (i.e. Fran’s).  $\Rightarrow$  (8) is **true**
  - c. **Mixed**: David said that Google cited Elin’s, Elin said that Google cited David’s and Fran said that Google cited hers (i.e. Fran’s).  $\Rightarrow$  (8) is **true**

Table 1 summarises the distribution of reciprocal readings. This suggest that reciprocal readings arise only when *sorezore* is a co-argument of its antecedent. It is reminiscent of the disjointness condition on pronouns: pronouns cannot be co-referential with a clause-mate antecedent. I propose that the reciprocal reading of *sorezore* comes from distributive evaluation of Condition B.

Antecedent	Position	Reflexive	Reciprocal	Mixed
Clause-internal	Argument	*	ok	*
	Possessor	ok	ok	ok
Clause-external	Argument	ok	ok	ok
	Possessor	ok	ok	ok

**Table 1** Availability of reflexive readings and reciprocal readings

Types	Names	Variables	Constants
$t$	truth value		1, 0
$e$	entities	$x, y, z, \dots$	Ann, Belle, Chris, ...
$s$	states	$g, h, i, \dots$	
$\pi$	registers	$v, v', v'', \dots$	$u_n$

**Table 2** The basic types in PCDRT

### 3 Plural Compositional DRT

In this paper, I adopt *Plural Compositional Discourse Representation Theory* (PC-DRT) (Brasoveanu 2008, 2011: *et seq.*). It suits my purpose because it allows explicit treatment of anaphoric relation at the collective level and at the distributive level.

PCDRT is a variant of *Compositional DRT* (CDRT) (Muskens 1996), which emulates the classical DRT with an ordinal many-sorted type logic. Its basic types are summarised in Table 2. Registers can be thought of as a small chunk of space to store one object and used to model discourse referents.<sup>5</sup> States can be thought of as lists of the current inhabitants of all registers and used to model variable assignments. A non-logical constant  $v$  of type  $\langle \pi, \langle se \rangle \rangle$  tells the occupant of a register  $u_n$  under a state  $g$ .<sup>6</sup> Table 3 exemplifies states and registers. For example,  $v(u_2)(g_1) = \text{Barbara}$  in this case.

In the classical DRT, the meaning of a sentence is represented as a *discourse representation structure* (DRS), which can be notated with a bracket as (10b) shows.

- (10) a. A dog smiled.  
b.  $[x | \text{dog}(x), \text{smiled}(x)]$

<sup>5</sup> Muskens (1996) defines *specific discourse referents* which are associated with registers whose values are fixed. I do not use them in this paper.

<sup>6</sup> Variable assignments are modelled as primitives in CDRT. Brasoveanu (2008) notes that this transition is to think about the type-lifted version of a variable  $x$  and an assignment  $g$ , i.e.  $\lambda g[g(x)]$ .

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	$u_1$	$u_2$	$u_3$	...
$g_1$	Angelika	Barbara	Craige	...

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**Table 3** Registers and states

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In CDRT, DRSs are abbreviations of expressions in the type logical object language.

(11) **Abbreviation 1** (Conditions):

- a.  $R\{u_1, u_2, \dots, u_n\} \Leftrightarrow \lambda g [R(v(u_1)(g))(v(u_2)(g)) \dots (v(u_n)(g))]$
- b.  $u_1 = u_2 \Leftrightarrow \lambda g [v(u_1)(g) = v(u_2)(g)]$

(12) **Abbreviation 2** (Negation, disjunction and material implication):

- a.  $\text{not } K = \lambda g \neg \exists k [K(g)(k)]$
- b.  $K \text{ or } K' = \lambda g \exists k [K(g)(k) \vee K'(g)(k)]$
- c.  $K \Rightarrow K' = \lambda g \forall i [K(g)(i) \rightarrow \exists j [K'(i)(j)]]$

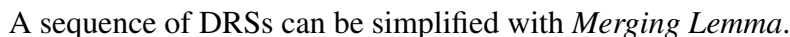
(13) **Abbreviation 3** (DRS):  $[u_1, \dots, u_n, | C_1, C_2, \dots, C_n]$   
 $= \lambda g \lambda h [g[u_1, \dots, u_n]h \& C_1(h) \& C_2(h) \& \dots \& C_n(h)]$

(14) **Abbreviation 4** (Sequencing):  $K; K' = \lambda g \lambda h \exists k [K(g)(k) \& K'(k)(h)]$

Now, (10a) is represented as (15a), which is an abbreviation of (15b).

- (15) a.  $[u_1 | \text{dog}\{u_1\}, \text{smiled}\{u_1\}]$
- b.  $\lambda g \lambda h [g[u_1]h \& \text{dog}(v(u_1)(h)) \& \text{smiled}(v(u_1)(h))]$

One can define common tools in the Montagovian compositional semantics in CDRT. With the “meta-type” convention (Brasoveanu 2008), T stands for  $\langle s, \langle st \rangle \rangle$  and E stands for  $\pi$ . These meta-types make CDRT-types homomorphic to the standard types used in Montague-style compositional semantics. For example, one place predicates of  $\langle et \rangle$  correspond to type  $\langle ET \rangle$  and generalised quantifiers of type  $\langle et, \langle et, t \rangle \rangle$  correspond to  $\langle ET, \langle ET, T \rangle \rangle$ . The denotation of (10a) is compositionally obtained as shown in (16).



- Merging lemma makes the clausal denotation in (16) equivalent to (15a).

Following [Link \(1983\)](#); [Schwarzschild \(1992\)](#); [Brasoveanu \(2008\)](#) among others, I take the domain of type  $e$  to be the power set of a given non-empty set of individuals. Accordingly, the sum formation operation  $+$  is modelled with union-formation, the part-of relation  $\sqsubseteq$  is modelled with subset relation and atomic individuals are singleton sets of an individual as exemplified in (18).

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- (18) a.  $\llbracket \text{Ann} \rrbracket = \{\text{Ann}\}$   
 b.  $\llbracket \text{Belle} \rrbracket = \{\text{Belle}\}$   
 c.  $\llbracket \text{Ann and Belle} \rrbracket = \{\text{Ann}\} + \{\text{Belle}\} = \{\text{Ann}, \text{Belle}\}$   
 d.  $\{\text{Ann}\} \sqsubseteq \{\text{Ann}, \text{Belle}\}$  and  $\{\text{Belle}\} \sqsubseteq \{\text{Ann}, \text{Belle}\}$

Due to plurality of variable assignments, discourse referent introduction is generalised so that it introduces a new value to each assignment in a point-wise manner as shown in (19) (Brasoveanu 2008, 2010; Dotlačil 2013; Henderson 2014; Kuhn 2015).<sup>8</sup>

- (19)  $G[u]H \Leftrightarrow \forall g[g \in G \rightarrow \exists h[h \in H \& g[u]h]] \& \forall h[h \in H \rightarrow \exists g[g \in G \& g[u]h]]$

Evaluation of a lexical relation is either collective or distributive in PCDRT.  $v(u_n)(G)$  is an abbreviation of  $\{v(u_n)(g) : g \in G\}$ .

- (20) a.  $R\{\cup u_1, \dots, \cup u_n\} = \lambda G[R(v(u_1)(G)), \dots, (v(u_n)(G))]$  (Collective)  
 b.  $R\{u_1, \dots, u_n\} = \lambda G[G \neq \emptyset \& \forall g[g \in G \rightarrow R(v(u_1)(g), \dots, v(u_n)(g))]]$  (Distributive)

Atomicity and cardinality are collective conditions as shown in (21).

- (21) a.  $\llbracket \text{ATOM} \rrbracket = \lambda P_{\langle ET \rangle} \lambda v_E [\llbracket \text{ATOM} \rrbracket \cup v]$   
 b.  $\llbracket \text{three} \rrbracket = \lambda P_{\langle ET \rangle} \lambda v_E [\llbracket 3 \text{ ATOMS} \rrbracket \cup v]$

The most important feature of PCDRT is that it acknowledges discourse-level distributivity. The  $\delta$  operator partitions a plural assignment into subsets of assignments so that each subset stores  $d$  value at  $u_n$  and DRSs under its scope are evaluated with respect to those subsets of assignments.

- (22) a.  $G_{u_n=d} = \{g : g \in G \& v(u_n)(g) = d\}$   
 b.  $\delta_{u_n}(D) = \lambda G \lambda H [v(u_n)(G) = v(u_n)(H) \& \forall d \in v(u_n)(G) [D(G_{u_n=d})(H_{u_n=d})]]$

(23b) shows the denotation of (23a) under a distributive reading. Here,  $\delta_{u_1}$  partitions an input plural assignment  $G$  into subsets of assignments so that each subset assigns a particular different value to  $u_1$ . Then, the scope of  $\delta_{u_1}$  is evaluated with respect to those subsets of assignments as shown in Table 5.

<sup>8</sup> An alternative definition of discourse referent introduction makes a newly added variable independent from the old values in the context (van den Berg 1996; Nouwen 2007; Law 2020).

(i)  $G[u]H \Leftrightarrow \exists D[H = \{h | \exists g \exists d[g[u]h \& v(u)(h) = d \& g \in G \& d \in D]\}]$

However, this definition does not work for the PCDRT entries of *each other* in Dotlačil (2013) and *sorezore* in this paper.



$G$	...	$\xrightarrow{\delta_{u_1}}$	$H$	$u_1$	$u_2$
$g_1$	...		$h_1$	girl <sub>1</sub>	cake <sub>1</sub>
$g_2$	...		$h_2$	girl <sub>1</sub>	cake <sub>2</sub>
$g_3$	...		$h_3$	girl <sub>2</sub>	cake <sub>3</sub>
			$h_4$	girl <sub>2</sub>	cake <sub>4</sub>
			$h_5$	girl <sub>3</sub>	cake <sub>5</sub>
			$h_6$	girl <sub>3</sub>	cake <sub>6</sub>

**Table 5** Update with  $\delta$ -operator

$G$	...	$u_n$	...	$\rightarrow$	$H$	...	$u_n$	...	$u_m$	...
$g_1$	...	$x$	...		$h_1$	...	$x$	...	$y$	...
$g_2$	...	$y$	...		$h_2$	...	$y$	...	$x$	...

**Table 6** Collective co-reference and distributive disjointness

- (23) a. Three girls <sup>$u_1$</sup>  (each) eat two cakes <sup>$u_2$</sup> .  
 b.  $[u_1 | 3 \text{ ATOM}\{\cup u_1\}, \text{girls}\{u_1\}, \delta_{u_1}([u_2 | 2 \text{ ATOM}\{\cup u_2\}, \text{cakes}\{u_2\}, \text{eat}\{u_1\}\{u_2\})]$

This discourse-level distributivity serves as a fundamental building block of the core proposal of this paper.

#### 4 Distributive evaluation of Condition B

In this section, I lay out the main proposal of this paper. First, [Dotlačil \(2013\)](#) offers a PCDR analysis of English reciprocal pronoun *each other* as shown in (24).

- (24)  $[[\text{each other}]]^{u_n} = \lambda P_{\langle ET \rangle} [u_m]; [(\cup u_m = \cup u_n); \delta_{u_n}([\cup u_m \cap \cup u_n = \emptyset]); P(u_n)]$   
 ([Dotlačil 2013](#))

In (24), *each other* only distributes over itself. The disjointness condition is under the scope of  $\delta$ , but the anaphoric condition is not. As a result, *each other* achieves collective co-reference and distributive disjointness as shown in Table 6.

However, *sorezore* cannot have the same denotation as *each other*. If it were, *sorezore* would have given rise to a reciprocal reading regardless of its syntactic position. Rather, the distribution of reciprocal readings of *sorezore* in §2 suggests that a reciprocal reading arises when *sorezore* and its antecedent are in a configuration

that violates Condition B. To derive this generalisation, I propose that distributive evaluation of Condition B offers a reciprocal reading.

For presentational purpose, I adopt a semantic version of Condition B (Reinhart & Reuland 1993). (25) states that unless a predicate is reflexive-marked with lexical reflexivity or a reflexive anaphor, its co-arguments have to be disjoint.

(25) **Condition B:** If a predicate is reflexive, it is reflexive-marked.

Co-reference and disjointness is contradictory if they are evaluated at the same level, but not if they are evaluated at different levels.

(26) a. Co-reference:  $\cup u_1 = \cup u_2$   
 b. Condition B:  $\cup u_1 \cap \cup u_2 = \emptyset$  **contradiction**

(27) a. Co-reference:  $\cup u_1 = \cup u_2$   
 b. Condition B:  $\forall h [h \in H_{u_1=d} \rightarrow v(u_1)(h) \cap v(u_2)(h) = \emptyset]$  **consistent**

I propose that *sorezore* collectively evaluates its co-reference condition, but distributively evaluates a lexical relation.

(28)  $[[\text{sorezore}]]^{u_n} = \lambda P_{\langle ET \rangle} [u_m]; [\cup u_m = \cup u_n]; \delta_{u_n}(P(u_m))$

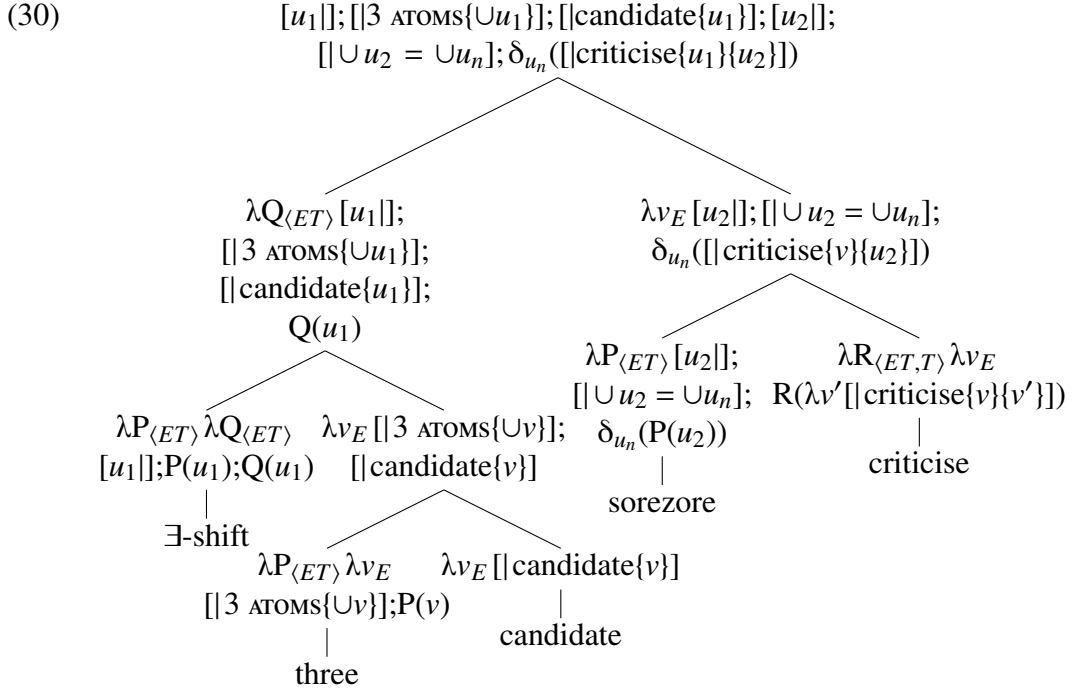
Now, the denotation of (29a) is given in (29b).

(29) a. San-nin-no koohosya<sup>u<sub>1</sub></sup>-ga **sorezore**<sup>u<sub>2</sub></sup>-o hihan-sita.  
 3-CL<sub>Person</sub>-GEN candidate-NOM DIST-ACC criticise-PAST  
 “The three candidates criticised each other.”  
 b.  $[[\text{(29a)}]] = [u_1]; [\cup 3 \text{ ATOMS}\{u_1\}]; [\text{candidate}\{u_1\}]; [u_2]; [\cup u_2 = \cup u_1];$   
 $\delta_{u_1}([\text{criticise}\{u_1\}\{u_2\}])$   
 $(= [u_1, u_2] \cup 3 \text{ ATOMS}\{u_1\}, \text{candidate}\{u_1\}, \cup u_2 = \cup u_1, \delta_{u_1}([\text{criticise}\{u_1\}\{u_2\}]))$

In (29b), the co-reference condition  $[\cup u_2 = \cup u_1]$  is collectively evaluated, whereas the predicate  $[\text{criticise}\{u_1\}\{u_2\}]$  is distributively evaluated. Since  $u_1$  and  $u_2$  are co-argument, Condition B requires them to be disjoint. On this point, it is crucial that  $[\text{criticise}\{u_1\}\{u_2\}]$  is evaluated with respect to each subset of assignments partitioned based on  $u_1$ . Thus, the disjointness condition of Condition B is also distributively evaluated. As a result, it achieves collective co-reference and distributive disjointness.

The sub-clausal composition of (29b) is given in (30). I adopt a PCDRT-version of  $\exists$ -operator and assume that covert type-shifting is freely applicable to common noun denotations in Japanese (Chierchia 1998).<sup>9</sup>

<sup>9</sup> The anaphoric component of “sorezore” is left unresolved in (30). A reciprocal reading is derived when  $u_n$  is co-indexed with  $u_1$  as shown in (29b).



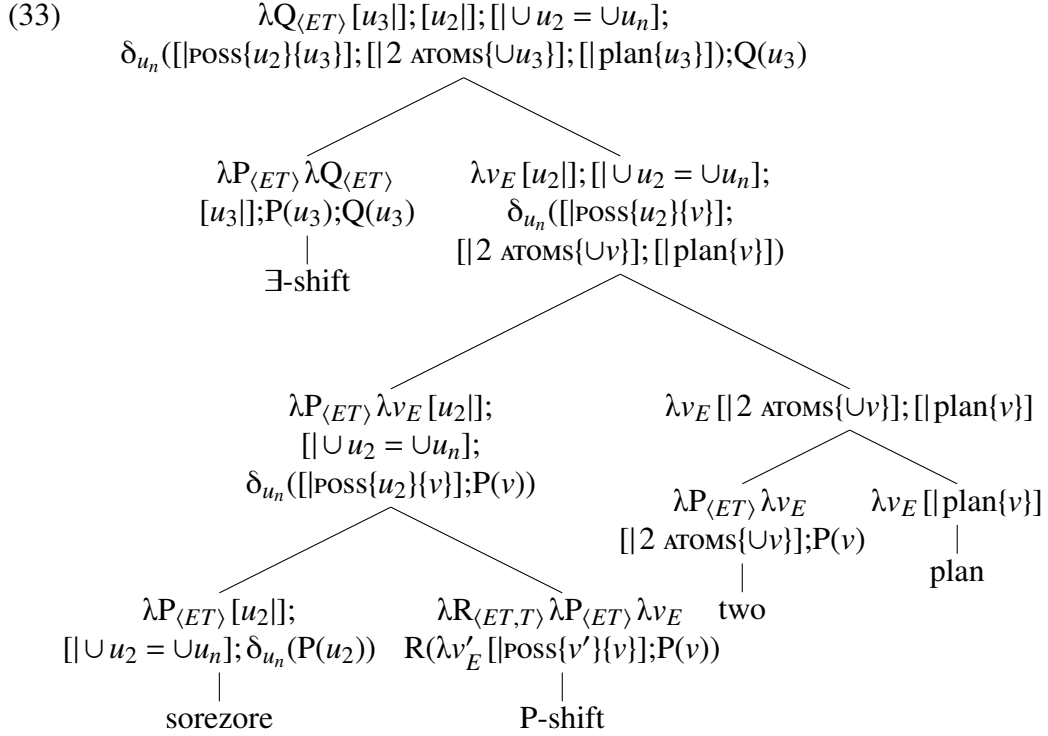
On the other hand, the denotation of (31a) is given in (31b).

- (31) a. Dezainaa-tachi<sup>u<sub>1</sub></sup>-ga **sorezore**<sup>u<sub>2</sub></sup>-no huta-tu-no an<sup>u<sub>3</sub></sup>-o  
 designer-PL-NOM DIST-GEN 2-CL<sub>Object</sub>-GEN plan-ACC  
 hihan-sita.  
 criticise-PAST  
 “The designers criticised their two plans.”
- b.  $[[ (31a) ]] = [u_1]; [[\text{NON-ATOMS}\{\cup u_1\}]; [\text{designer}\{u_1\}]; [u_3]; [u_2]; [[\cup u_2 = \cup u_1];$   
 $\delta_{u_1}([\text{POSS}\{u_2\}\{u_3\}]; [[2 \text{ ATOMS}\{\cup u_3\}]; [\text{plan}\{u_3\}]; [\text{criticise}\{u_1\}\{u_3\}])$   
 $(= [u_1, u_2, u_3 | \text{NON-ATOMS}\{\cup u_1\}, \text{designer}\{u_1\}, \cup u_2 = \cup u_1, \text{criticise}\{u_1\}\{u_3\}])$   
 $\delta_{u_1}(\text{POSS}\{u_2\}\{u_3\}, [[2 \text{ ATOMS}\{\cup u_3\}, \text{plan}\{u_3\}])$

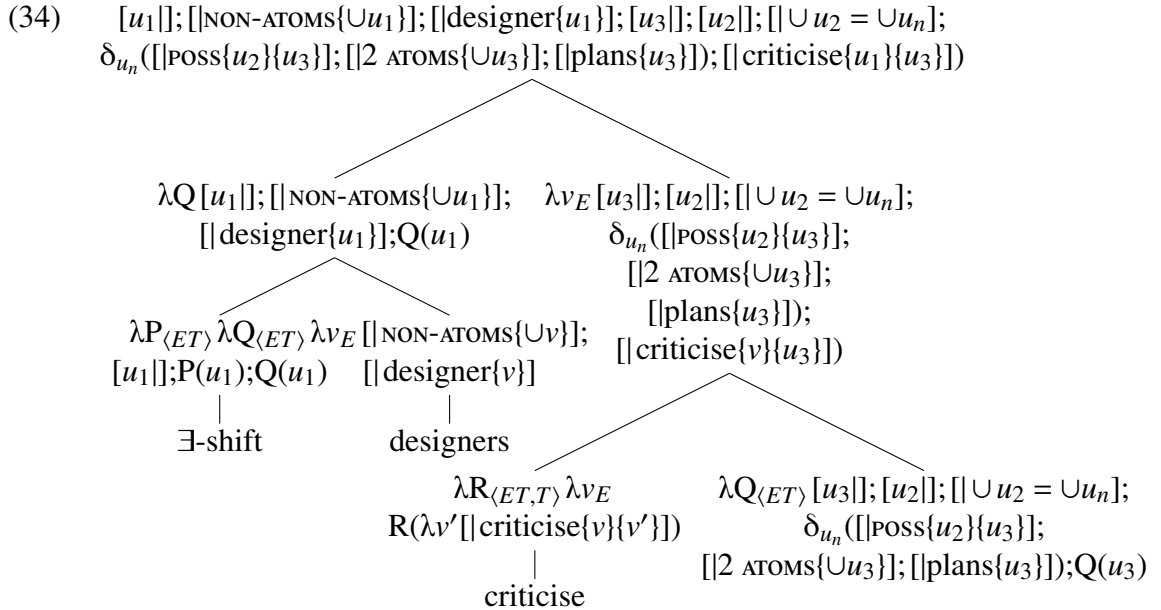
Again, the co-reference condition  $[[\cup u_2 = \cup u_1]]$  is collectively evaluated. However, the predicate  $[[\text{criticise}\{u_1\}\{u_3\}]]$  is collectively evaluated in this case. This is because *sorezore* is combined with an NP as a possessive pronoun. Although I do not commit to any particular analysis of possessive NPs in Japanese, I assume a type-shifting operation P-shift for an expository sake.

$$(32) \quad \text{P-shift}(R) = \lambda P_{\langle ET \rangle} \lambda v_E R(\lambda v'_E [[\text{POSS}\{v'\}\{v\}]; P(v)])$$

(32) turns an argument nominal into an NP modifier. (33) shows how *sorezore* is combined with an NP when it occurs as a possessive pronoun.



(34) shows the composition of the full clausal denotation.



As the verbal predicate is not under the scope of the  $\delta_{u_1}$  operator, it achieves

collective co-reference, but dependency at the distributive level is underspecified.<sup>10</sup>

In this way, (28) derives a reciprocal reading only when the configuration between *sorezore* and its antecedent violates Condition B. For this analysis, it is crucial that *sorezore* takes scope over a predicate. This predicts a contrast between *each other* and *sorezore* in terms of their scope.<sup>11</sup> Dotlačil (2013) argues that *each other* only scopes over the disjointness condition. In (35), co-variation between *a Christmas present* and *the two children* is strongly dispreferred.

(35) The two children<sup>u<sub>1</sub></sup> gave each other<sup>u<sub>2</sub></sup> a Christmas present<sup>u<sub>3</sub></sup>.

(Moltmann 1992: 426)

This is predicted by his analysis because (24) does not scope over anything other than the disjointness condition and thus *a Christmas present* is not under the scope of  $\delta$ . On the other hand, (28) predicts the opposite: *sorezore* should allow co-variation between children and presents in this case. This prediction is borne out: (36) allows co-variation between children and presents as default even though a numeral quantifier *hito-tsu* (one-CL) modifies the object.

(36) Huta-ri-no kodomo<sup>u<sub>1</sub></sup>-ga **sorezore**<sup>u<sub>2</sub></sup>-ni kurisumasu presento<sup>u<sub>3</sub></sup>-o **hito-tsu**  
 2-CL-GEN child-NOM DIST-DAT Christmas present-ACC one-CL  
 oku-tta.  
 give-PAST

“The two children gave each other one Christmas present.”

The difference between (35) and (36) is expected. Since the disjointness effect comes from Condition B, *sorezore* always takes scope over a predicate, whereas it is not necessary for *each other* because it lexically encodes the disjointness condition. This is another consequence of the difference in how the disjointness is realised in cases of *each other* and in cases of *sorezore*.

## 5 Lack of reciprocal readings with pronouns

In this section, I discuss reflexives and pronouns in English to check if the proposed analysis correctly predicts the lack of reciprocal readings with these expressions.

First, consider cases in which English pronouns occur under the scope of a distributive universal quantifier as shown in (37).

(37) \* Every<sup>u<sub>1</sub></sup> candidate criticised {him / her / them}<sup>u<sub>2</sub></sup><sub>u<sub>1</sub></sub>.

<sup>10</sup> See Cable (2014) for an event-based analysis of how an underspecified cumulative predication gives rise to a weak truth condition.

<sup>11</sup> I thank Jeremy Kuhn for bringing this issue to my attention.

In this case, the co-reference condition between  $u_1$  and a pronoun is distributively evaluated. At the same time, the predicate *criticise* is also distributively evaluated. Thus,  $u_1$  and  $u_2$  have to be distributively co-referential and distributively disjoint at the same time. This leads to contradiction.

Similarly, English reflexives under the scope of *every* distributively evaluates the co-reference condition. Thus, it lacks a reciprocal reading.

- (38) Every <sup>$u_1$</sup>  candidate criticised {himself / herself / \*themselves} <sup>$u_2$</sup> .  
 $\neq$  The candidates criticised each other.

In these cases, the proposed analysis correctly predicts lack of reciprocal readings.

However, there are some problematic cases. [Nouwen \(2007\)](#) shows that plural pronouns can be either dependent on or independent from their antecedent.<sup>12</sup>

- (39) Every student <sup>$u_1$</sup>  chose a book <sup>$u_2$</sup> . They <sup>$u_3$</sup>  <sub>$u_1$</sub>  each wrote an essay <sup>$u_4$</sup>  about {it / them} <sup>$u_5$</sup>  <sub>$u_2$</sub> . ([Nouwen 2007](#): 136)

This shows that the co-reference condition of plural pronouns is not necessarily evaluated under the scope of the  $\delta$  operator. However, the predicate *wrote* is still evaluated distributively. Thus, the proposed analysis wrongly predicts that a plural pronoun can induce a reciprocal reading in such cases.

In addition, (40) shows that a plural pronoun cannot take one of its co-participants as its antecedent even when it is not under the scope of  $\delta$  operator.

- (40) \* Three candidates <sup>$u_1$</sup>  criticised them <sup>$u_2$</sup>  <sub>$u_1$</sub> .

The proposed analysis wrongly predicts that *them* in (40) has a weak truth condition which subsumes a reflexive reading, a reciprocal reading and a mixed reading.

One possible solution is to stick to the traditional view on pronouns, in which pronouns do not introduce a new discourse referent.<sup>13</sup> In this option, pronouns always have the same value as its antecedent both at the collective level and at the distributive level. Thus, the possibility of reciprocal readings is precluded. This suggests that *sorezore* and plural pronouns differ in two aspects. Firstly, *sorezore* encodes its own  $\delta$  operator, while plural pronouns do not. Secondly, *sorezore* introduce a new discourse referent, while plural pronouns do not.<sup>14</sup>

<sup>12</sup> I thank Jeremy Kuhn for bringing this case to my attention.

<sup>13</sup> Another possible solution is to admit that pronouns introduce a new discourse referent, but they use the dependency-free discourse referent introduction ([van den Berg 1996](#); [Nouwen 2007](#); [Law 2020](#)). This suggests that both of the two types of discourse referent introduction are necessary and it opens a new research question of the division of labour between them. I leave this issue for future research.

<sup>14</sup> It is plausible that reflexives also introduce a new discourse referent. See [Cable \(2014\)](#) for cross-linguistic observation that reflexives with a plural antecedent give rise to a weak truth condition, which includes a reciprocal reading and a mixed reading.

## 6 Variation among reciprocal strategies

So far, I have argued that *sorezore* is not inherently reciprocal and the disjointness condition comes from distributive evaluation of Condition B. This suggests that the disjointness condition is independent of anaphoricity and distributivity. In this section, I discuss other reciprocal strategies and show that (i) some reciprocal strategies other than *sorezore* resort to distributive evaluation of Condition B and (ii) some reciprocal strategies motivate further decomposition of the distributivity component and the anaphoricity component.

### 6.1 Intra-linguistic variation

Japanese has a pronoun *otagai* and a verbal suffix *-au*, which have been treated as reciprocal items.

- (41) a. San-nin-no koohosya-tachi-ga **otagai**-o hihansi-ta.  
           3-CL-GEN candidate-PL-NOM other-ACC criticise-PAST  
       b. San-nin-no koohosya-tachi-ga hihansi-**at**-ta.  
           3-CL-GEN candidate-PL-NOM criticise-RECP-PAST  
           “The three candidates criticised each other.”

Firstly, *otagai* is quite similar to *sorezore*: it has a weak truth condition at the possessor position.

- (42) [Mary to Bill]<sup>u<sub>1</sub></sup>-ga **otagai**<sup>u<sub>2</sub></sup><sub>u<sub>1</sub></sub>-no kodomo<sup>u<sub>3</sub></sup>-o yuuenchi-ni  
       [Mary and Bill]-NOM each other-GEN child-ACC park-LOC  
       ture-te-it-ta.  
       take-and-go-PAST  
       “Mary and John took {their / each other’s} children to the park.”

(Imani & Peters 1996: 100)

This suggests that reciprocity is not inherent to *otagai*, too. I tentatively propose a similar semantics for *otagai* and *sorezore*.<sup>15</sup>

- (43)  $[[otagai]]^{u_n} = \lambda P_{\langle ET \rangle} [u_m]; [|\cup u_m = \cup u_n]; \delta_{u_n}(P(u_m))$

Thus, *ogatai* provides another case of non-inherent reciprocity in which the disjointness condition comes from distributive evaluation of Condition B.

<sup>15</sup> There are several aspects in which *sorezore* and *otagai* behave differently, but the main point of discussion here is that both expressions induce a reciprocal reading in some environments, but not in other environments.

Secondly, *-au* allows non-reciprocal pluractional readings (Yamada 2010). In (44), *-au* attaches to an intransitive verb *odoru* (dance) and it expresses that each of the children danced on their own.

- (44) Kodomo-tachi-ga odori-**at**-ta.  
 child-PL-NOM dance-RECP-PAST  
 “The children danced competing with each other.” (Yamada 2010: 268)

Furthermore, (45) shows that *-au* is incompatible with collective predicates, suggesting that it distributively evaluates the verbal predicate it attaches to.

- (45) \* Karera-ga koodoo-ni atsumari-**at**-ta.  
 they-NOM lecture hall-at gather-RCPL-PAST  
 “They gathered at the lecture hall competing with each other.”

However, the scopal property of *-au* is different from that of *sorezore*. (46) shows that *-au* cannot take scope over the internal argument of a verb.

- (46) Karera-ga ni-satu-no hon-o yomi-**at**-ta.  
 they-NOM 2-CL-GEN book-ACC read-RCPL-PAST  
 a. “They read two books competing with each other.”  
 b. \* “They read two books each.”

These observations suggest that *-au* is not inherently reciprocal, but it is a distributor which only distributes over a verbal predicate. I analyse *-au* as a type-flexible verbal modifier as shown in (47).

- (47) a.  $[[V\text{-}au]] = \lambda v_E [\delta_v(V(v))]$  (Intransitive)  
 b.  $[[V\text{-}au]] = \lambda Q_{\langle ET, T \rangle} \lambda v_E [Q(\lambda v'_E [\delta_v(V(v)(v'))])]$  (Transitive)

(44) involves an intransitive verb *odoru* (dance) and (47a) correctly predicts that its non-reciprocal pluractional reading.<sup>16</sup> At the same time, the  $\delta$  operator above the verbal predicate accounts for the incompatibility of *-au* with a collective predicate as shown in (45). The same distributive reading is observed when a verb is transitive. However, unlike *sorezore*, *-au* is a verbal suffix. Thus, it does not scope over verbal arguments as shown in (46).

<sup>16</sup> I assume that the competing implication in (44) does not come from reciprocity, but from multiplicity of non-overlapping events. This requirement can easily be implemented under PCDRT with events, but I do not go into the detail as it is not directly relevant to the main point of this paper. See also Yamada (2010). His event-based analysis of *-au* does not semantically encode this implication, but rather treats it as a pragmatic inference.



Now, reciprocal readings of *-au* can be obtained with a pronoun whose co-reference condition is evaluated above the  $\delta$  operator. Considering that Japanese is a pro-drop language, I propose that there is a null pronoun *pro* at the object position. The combination of *pro* and *-au* emulates *sorezore* as shown in (48).<sup>17</sup>

- (48) a.  $[[\text{pro}]]^{u_n} = \lambda P_{\langle ET \rangle} [u_m]; [\cup u_m = \cup u_n]; P(u_m)$   
 b.  $[[\text{pro V au}]]^{u_n} = \lambda v_E [u_m]; [\cup u_m = \cup u_n]; \delta_v(V(v)(u_m))$

Thus, *-au* only encodes the distributivity component: the anaphoricity component comes from *pro* and the disjointness component comes from Condition B. This offers a piece of evidence for the three-way decomposition of reciprocity.

## 6.2 Inter-linguistic variation

The reciprocal strategies I proposed so far are comparable to the reciprocal strategies in other languages. First, Brazilian Portuguese exhibits *scattered reciprocals*, in which two items corresponding to the two components occur in different positions.

- (49) Os elefantes estão **um** encarando **o outro**.  
 the elephants are one staring the other  
 “The elephants are staring at each other.” (Kobayashi 2021: 735)

Kobayashi (2021) claims that *um+(o) outro* and *each other* use the same building blocks, but differ in how they are built in syntax. He proposes that *um* distributes over pairs of individuals and *o outro* encodes the disjointness condition as shown in (50). This is in line with the classic compositional approach to *each other* in Heim, Lasnik & May (1991).<sup>18</sup>

- (50) a.  $[[\text{um}]]^{u_n} = \lambda P_{\langle ET \rangle} \lambda v_E [u_m]; [\cup u_m = \cup u_n]; \delta_{u_n}(\delta_{u_m}(P(v)))$   
 b.  $[[\text{o outro}]]^{u_n} = \lambda P_{\langle ET \rangle} [u_m]; P(u_m); [\cup u_m \cap \cup u_n = \emptyset]$

Second, Faller (2007) shows that a reciprocal strategy in Cuzco Quechua resorts to Condition B at the sub-event level.

- (51) Hayt’a-**na-ku**-n-ku.  
 kick-PA-REFL-3rd person-PL  
 “They kick each other.” (Faller 2007: 255)

<sup>17</sup> For this analysis of *-au*, *pro* has to introduce a new discourse referent unlike English overt pronouns. This predicts that *pro* can induce a reciprocal reading without *-au* when it takes a clause-internal antecedent. Although the judgement is not fully clear, Tatsumi (2017) shows that null arguments in Japanese sometimes allow a reciprocal reading. Importantly, such null arguments still disallow a reflexive reading, which is predicted by distributive evaluation of Condition B.

<sup>18</sup> Kobayashi (2021) takes *each other* to be semantically complex on a par with Heim et al. (1991), but propose that *each* is always in situ contra Heim et al. (1991).

	Distributivity	Anaphoricity	Disjointness
English	<i>each other</i>		
Brazilian Portuguese	<i>um</i>		<i>o outro</i>
Cuzco Quechua	<i>-na</i>	<i>-ku</i>	underspecified
Japanese	<i>sorezore</i> / <i>otagai</i>		underspecified
	<i>-au</i>	<i>pro</i>	underspecified

**Table 7** Inter- and intra-linguistic typology of reciprocals

Faller (2007) analyses *na* as a pluractional morpheme and *ku* as a reflexive morpheme.<sup>19</sup> Crucially, reflexivity may hold at any intermediate level between plural individuals and atomic individuals.<sup>20</sup> When *-ku* establishes reflexivity at the level of plural individuals, it is compatible with disjointness at the level of atomic individuals. Here, I recast her static analysis under the proposed account as shown in (52).

- (52) a.  $[[\text{-na}]]^{u_n} = \lambda R_{\langle E, ET \rangle} \lambda v'_E \lambda v_E [\delta_v(R(v)(v'))]$   
 b.  $[[\text{-ku}]]^{u_n} = \lambda R_{\langle E, ET \rangle} \lambda v_E [u_m]; [\cup u_m = \cup u_n]; R(v)(u_m)$   
 c.  $[[V\text{-na-ku}]]^{u_n} = \lambda v_E [u_m]; [\cup u_m = \cup u_n]; \delta_v(R(v)(u_m))$

The discussion so far suggests the pattern of variation summarised in Table 7. Although two-way decomposition of reciprocity has already been proposed (Heim et al. 1991; Moltmann 1992; Sternefeld 1998: to note a few), this three-way decomposition of reciprocity makes the semantic contribution of reciprocity clearer, shedding light on interaction between dynamic distributivity and Condition B.

## 7 Conclusion

The non-inherent reciprocity of *sorezore* suggests that distributive evaluation of Condition B provides a reciprocal reading. This strategy is applicable to other reciprocal strategies in Japanese and in other languages. Discussion on *-au* and a reciprocal strategy in Cuzco Quechua further suggests that the anaphoricity component and the distributivity component are not always realised as a single expression. This suggests that the semantics of reciprocity consists of three independent components.

<sup>19</sup> See Faller (2007) for the relevant data and discussion.

<sup>20</sup> Faller (2007) analyses reflexivity with Neo-davidsonian semantics.

- (i)  $[[\text{-ku}]] = \lambda R \lambda x \lambda e \forall y [[y \sqsubseteq x \ \& \ \text{ATOM}(y)] \rightarrow \exists z \exists e' [z \sqsubseteq x \ \& \ y \sqsubseteq z \ \& \ e' \sqsubseteq e R(z)(z)(e')]]$

This definition just requires reflexivity to be satisfied at some intermediate level. Thus, reflexivity may hold at the level of plural individuals or at the level of atomic individuals.

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