Reciprocal scope in Mandarin *

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1. Overview

Reciprocity has been much studied in the literature, but previous theoretical accounts have predominantly focused on pronominal forms like English *each other*. Mandarin offers an opportunity to study a wider range of reciprocal forms, because it has adverbial reciprocals in addition to pronominal forms. Adverbial reciprocals appear preverbally, whereas pronominal forms appear in typically nominal positions. Both adverbial and pronominal reciprocals can co-occur in a single clause.

Here, we argue that the difference between English and Mandarin pronominal reciprocals on the one hand, and Mandarin adverbial reciprocals on the other, is that Mandarin adverbial reciprocals need not contribute a discourse referent. This means that a single reciprocal relation can be expressed by both a nominal and an adverbial reciprocal without incoherence. This is in contrast to the standard operator-based view of reciprocity, which is hard to reconcile with multiple reciprocal expressions, whether of the same reciprocal relation or of multiple reciprocal relations.

We adopt the analysis of reciprocals put forward in Haug and Dalrymple (2020) and extend it to Mandarin. Our analysis of Mandarin reciprocals takes advantages of this approach, most notably its ability to account for apparent "scope" ambiguities by dissociating the contribution of reciprocity from that of distributivity. The approach also correctly predicts the existence of "crossed" readings ("Romeo and Juliet suspected that they hated each other"), which are incorrectly ruled out by most other approaches.

Section 2 presents Mandarin pronominal and adverbial reciprocal forms. Section 3 discusses examples containing multiple reciprocal forms. In Section 4, we present the theory

*For helpful discussion, we are grateful to Michael Yoshitaka Erlewine and the members of the syntax-semantics reading group at the National University of Singapore, especially Zheng Shen, Kenyon Branan, Joey Lim and Lim Junjie; Cheng Yuanchen, Hu Mengting, Mei Yunbo, Tang Qianchen, Wei Xiaojun, Yu Zichuan, Xia Zeng; and to the audience at NELS 51 at the Université du Québec à Montréal (UQAM), especially Raj Singh, Yimei Xiang and Jianrong Yu. Part of this research is supported by the Singapore Ministry of Education under the grant "Subjecthood in Southeast Asia: Description and Theory" (MOE2017-T2-2-094).

in which our analysis is couched, Partial Plural Compositional Discourse Representation Theory, and in Section 5 we extend the basic analysis to Mandarin. Section 6 discusses wide and narrow scope for reciprocals, and Section 7 presents Mandarin examples with reciprocals in both the matrix and the embedded clause. Section 8 concludes.

2. Mandarin reciprocal forms

Reciprocity in Mandarin can be expressed by the pronominal reciprocal *bǐcǐ* and by the adverbial reciprocals *hùxiāng* and *bǐcǐ*.[1] Thus the expression *bǐcǐ* has both a pronominal use (and can appear in argument positions) and an adverbial use (appearing preverbally); we motivate this ambiguity in section 2.2.

2.1 Pronominal reciprocal: *bǐcǐ*

The pronominal reciprocal *bǐcǐ* appears in typically nominal positions.[2]

(1) *Zhāngsān hé Lǐsì xǐhuān bǐcǐ.*
Zhangsan and Lisi like BICI
'Zhangsan and Lisi like each other.'

(2) *Zhāngsān hé Lǐsì xǐhuān [bǐcǐ de yōudiǎn].*
Zhangsan and Lisi like BICI DE good.points
'Zhangsan and Lisi like each other's good points.'

(3) *Zhāngsān hé Lǐsì xiàng bǐcǐ gàobái.*
Zhangsan and Lisi toward BICI confess
'Zhangsan and Lisi confessed (their feelings) to each other.'

It can appear as the subject of an embedded clause:

(4) *Zhāngsān hé Lǐsì rènwéi [bǐcǐ hěn shuài].*
Zhangsan and Lisi think BICI very handsome
'Zhangsan and Lisi think that each other is (very) handsome.'

The pronominal reciprocal needs a local antecedent, and cannot appear in nonsubject position of an embedded clause if the intended antecedent is in the matrix clause:

(5) **[Zhāngsān hé Lǐsì]$_i$ rènwéi [Wángwǔ xǐhuān {bǐcǐ/∅$_i$}].*
[Zhangsan and Lisi]$_i$ think Wangwu like {BICI/∅$_i$}
Intended: 'Zhangsan thinks that Wangwu likes Lisi, and Lisi thinks that Wangwu likes Zhangsan.'

[1] There is another adverbial reciprocal *xiānghù* which appears to be a variant of *hùxiāng*.
[2] Abbreviations: BA object preposing marker, DE linker, IMPF imperfective, PFV perfective

The pronominal form *duìfāng* can express a meaning similar to *bǐcǐ* in examples like (1), and has been analyzed as a reciprocal pronoun. However, *duìfāng* can also express a non-reciprocal meaning roughly equivalent to 'partner, counterpart' (6). This is not possible for *bǐcǐ*. We do not analyze *duìfāng* as a true reciprocal, and set it aside for the rest of this paper.

(6) *Lǐsì bǎ qiú dǎ-guò-le wǎng. Guòhòu, duìfāng bǎ qiú dǎ-le huílái.*
Lisi BA ball hit-over-PFV net. later DUIFANG BA ball hit-PFV back
literally 'Lisi hit the ball over the net. Later, DUIFANG hit it back.'

2.2 Adverbial reciprocals: *hùxiāng/bǐcǐ*

Mandarin has two adverbial reciprocals that appear preverbally: *hùxiāng* and *bǐcǐ*.

(7) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} xǐhuān.*
Zhangsan and Lisi {HUXIANG/BICI} like
'Zhangsan and Lisi like each other.'

We argue that *bǐcǐ* in preverbal position is not merely a pronominal *bǐcǐ* that has been fronted. Firstly, preverbal *bǐcǐ* can co-occur with another pronominal reciprocal in object position, as shown in (8). Since the predicate *xǐhuān* 'like' is a transitive verb taking only one internal argument, the preverbal *bǐcǐ* in (8) cannot be a fronted pronominal reciprocal.

(8) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} xǐhuān bǐcǐ.*
Zhangsan and Lisi {HUXIANG/BICI} like BICI.
'Zhangsan and Lisi like each other.'

Secondly, preverbal *bǐcǐ* can appear in the main clause of a biclausal sentence even when the matrix verb does not take a direct object, as shown in (9).

(9) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} rènwéi [tāmen xǐhuān bǐcǐ].*
Zhangsan and Lisi {HUXIANG/BICI} think they like BICI
'Zhangsan and Lisi think they like each other.'

3. Multiple reciprocals

English allows sentences with multiple reciprocal pronouns. Such examples are generally ambiguous; in (10), the antecedent of the second reciprocal can be the subject (reading 1) or the first reciprocal (reading 2):

(10) *Zhangsan (Z) and Lisi (L) gave each other photos of each other.*
(a) Reading 1: Z gave L photos of L, and L gave Z photos of Z.
(b) Reading 2: Z gave L photos of Z, and L gave Z photos of L.

Similar examples can be constructed in Mandarin, with the same range of readings.

(11) *Zhāngsān hé Lǐsì sòng-le bǐcǐ [bǐcǐ de zhàopiàn].*
Zhangsan and Lisi gave-PFV BICI BICI DE photo
'Zhangsan and Lisi gave each other photos of each other.'

Multiple reciprocals describing a single reciprocal relation are also allowed in Mandarin, as in (12). These sentences can feel repetitious, especially if they contain multiple reciprocals of the same form (e.g., two instances of *bǐcǐ*). In fact, some speakers appeared to have difficulty parsing such sentences; we offer some speculations as to why in section 7. However, these sentences improve when the pronominal reciprocal is a possessor, as in (13).

(12) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} xǐhuān bǐcǐ.*
Zhangsan and Lisi {HUXIANG/BICI} like BICI.
'Zhangsan and Lisi like each other.'

(13) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} qiān-zhe [bǐcǐ de shǒu].*
Zhangsan and Lisi {HUXIANG/BICI} hold-IMPF BICI DE hand
'Zhangsan and Lisi are holding each other's hand.'

Such examples pose a challenge to quantificational theories of reciprocity, in which multiple expression of a single reciprocal meaning is unexpected. Our analysis predicts the attested patterns, including available reciprocal scopes.

An adverbial reciprocal can appear in the matrix clause of a biclausal sentence if a pronominal reciprocal also appears in the subordinate clause.

(14) *Tāmen {hùxiāng/bǐcǐ} rènwéi [tāmen xǐhuān *(bǐcǐ)].*
they {HUXIANG/BICI} think they like *(BICI)
'They think they like each other.'

Marking the same reciprocal relation in both the main clause and the subordinate clause as in (14) is slightly awkward, though such sentences improve when the pronominal reciprocal is a possessor, as in (15).

(15) *Tāmen {hùxiāng/bǐcǐ} rènwéi [tāmen dǎbài-le [bǐcǐ de jūnduì]].*
they {HUXIANG/BICI} think they defeat-PFV BICI DE troops
'They think they defeated each other's troops.'

Multiple adverbial reciprocals in biclausal sentences as in (16) are judged as redundant and awkward.

(16) *?Tāmen {hùxiāng/bǐcǐ} rènwéi [tāmen {hùxiāng/bǐcǐ} xǐhuān].*
they {HUXIANG/BICI} think they {HUXIANG/BICI} like
'They think they like each other.'

a. *Cats appeared.*

u_1
$cat(u_1)$ $appear(u_1)$

b. *Two cats appeared.*

u_1
$cat(u_1)$ $2\text{-}atoms(\cup u_1)$ $appear(u_1)$

c. *Cats appeared. They yawned.*

$u_1\ u_2$
$cat(u_1)$ $appear(u_1)$ $yawn(u_2)$ $u_2 \rightarrow u_1$

d. *Cats chased them.*

$u_1\ u_2$
$cat(u_1)$ $chase(u_1, u_2)$ $\partial(u_2 \neq u_1)$

Figure 1: Discourse representation structures in Partial Plural CDRT

4. Reciprocal meaning in Partial Plural CDRT

Haug and Dalrymple (2020) present a relational analysis of reciprocity in the theoretical setting of Partial Plural Compositional Discourse Representation Theory, and we adopt this theory in our analysis of Mandarin reciprocals. In this section we describe the theory and present some of its general advantages over alternative theories of reciprocity.

Partial Plural CDRT is based in the insights of classic DRT (Kamp and Reyle 1993) in a Compositional DRT setting (Muskens 1996): the meaning of a sentence is represented by a Discourse Representation Structure (DRS) which relates an input information state (the state of the discourse before the sentence is uttered) to an output information state, updating the input information state with new discourse referents introduced by the sentence and new information about the discourse referents under discussion. Van den Berg (1996) proposes an enrichment of the theory to account for plurality: in his theory, a DRS is a relation between sets of information states rather than a single information state, as we illustrate below. Brasoveanu (2007) recasts van den Berg's insights in the setting of Compositional DRT, producing Plural CDRT.

In separate work, Haug (2014) proposes Partial CDRT, updating standard CDRT with an empirically more satisfactory theory of anaphoric reference within a partial theory of types. Haug's view allows for the interpretation of DRSs with unresolved anaphors, treating anaphoric resolution as a presupposition rather than requiring anaphoric resolution to be specified in the input to semantic analysis, as in previous CDRT treatments. Haug and Dalrymple (2020) extend Haug's Partial CDRT theory to the plural setting, resulting in Partial Plural CDRT, the theoretical setting of our analysis.

In Partial Plural CDRT, the sentence *Cats appeared* has the DRS in Figure 1a. In the set of output information states for this example, each output information state must have a value for u_1 such that u_1 is a cat, and u_1 appeared. Crucially, different output states might assign different cats to u_1, so that u_1 can range over more than one cat.[3]

We can also place constraints on the collection of values for u_1 across assignments, $\cup u_1$, as in Figure 1b. Here, each output information state must have a value for u_1 which is a cat who appeared, and summing across all output information states, there must be two cats.

We follow Haug (2014) in assuming that anaphors introduce their own discourse referents, and Haug and Dalrymple (2020) in representing the anaphoric relation between an

[3]We follow the standard treatment of plural forms as compatible with singular referents (Krifka 1989).

anaphor and its antecedent by means of an arrow ($\rightarrow$), as in Figure 1c. This representation is a simplification of the full treatment of Haug (2014), abbreviating the presuppositional requirement for the anaphor to find an antecedent (see Haug and Dalrymple 2020 for further discussion). Noncoreference constraints are represented as inequality specifications, with explicit use of the presupposition connective ∂ of Beaver (1992), as in Figure 1d.

Haug and Dalrymple (2020) propose the DRS in (17) for an English sentence including a reciprocal. The diagram represents a plural information state that verifies the DRS.

(17) *Two cats fight each other.*

$u_1\ u_2$
$cat(u_1)$ $2\text{-}atoms(\cup u_1)$ $\cup u_2 \rightarrow \cup u_1,\ \partial(u_1 \neq u_2)$ $fight(u_1, u_2)$

	u_1	u_2
s_1	cat_1	cat_2
s_2	cat_2	cat_1

This analysis builds on previous proposals in a dynamic setting by Murray (2008) and Dotlačil (2013), according to which the reciprocal behaves like a plural anaphor in requiring cumulative identity between the reciprocal and its antecedent ($\cup u_2 \rightarrow \cup u_1$) across information states, while also imposing a noncoreference requirement within each information state ($\partial(u_1 \neq u_2)$). In other words, the reciprocal and its antecedent range over the same set of cats, but require a different cat to participate in the reciprocal relation in each information state. In a situation with two cats, cat_1 and cat_2, we have the sample output plural information state represented in (17): in information state s_1, cat_1 fights cat_2, and in information state s_2, cat_2 fights cat_1.

This approach offers several advantages over quantificational or operator-based approaches. First, this approach accounts for reflexive/reciprocal underspecification in languages that express reflexives and reciprocals using the same form (Murray 2008) by saying that such an underspecified form simply encodes a cumulative coreference requirement but not the state-level noncoreference requirement. Second, this approach explains why reciprocals pattern with plurals rather than quantifiers in the availability of distributive and cumulative readings. Third, this approach accommodates collective readings (Dotlačil 2013) and mixed individual/group readings (Dalrymple et al. 1998) for reciprocal antecedents. Last, and perhaps most relevant to this paper, this approach accommodates multiple reciprocals within a single sentence of the sort discussed in section 3, where multiple distributive operators would result in incoherence. See Haug and Dalrymple (2020) for an extended discussion.

5. Extending the analysis to Mandarin

The English reciprocal contributes a discourse referent, a coreference constraint requiring cumulative identity between the reciprocal and its antecedent, and a noncofererence constraint that applies within each information state. It is the latter two contributions which are

the hallmark of reciprocity; Mandarin reciprocals also require cumulative identity between two arguments and noncoreference within each information state.

Mandarin pronominal reciprocals pattern with those in English. However, Mandarin adverbial reciprocals can but need not introduce a discourse referent into the DRS. This allows a reciprocal relation to be multiply specified by both an adverbial and pronominal reciprocal, with each form (redundantly) enforcing cumulative identity across information states, and noncoreference within each information state.

In (18), u_1 ranges over the individuals Zhangsan and Lisi across the set of information states: we use set notation to denote the plurality of individuals Zhangsan and Lisi. The pronominal reciprocal *bǐcǐ* supplies a discourse referent u_2 that is anaphorically dependent on u_1 in that u_2 must be cumulatively identical to u_1 across information states but different from u_1 within each information state.

(18) *Zhāngsān hé Lǐsì xǐhuān bǐcǐ.*
Zhangsan and Lisi like BICI
'Zhangsan and Lisi like each other.'

$u_1\ u_2$
$\cup u_1 = \{Zhangsan, Lisi\}$ $\cup u_2 \rightarrow \cup u_1,\ \partial(u_2 \neq u_1)$ $like(u_1, u_2)$

Adverbial reciprocals as in (19) optionally contribute a discourse referent, but they have to contribute one in this example or the resulting DRS will be ill-formed. This discourse referent is subject to the same coreference and noncoreference requirements as in (18), and the DRS for (19) is the same as (18).

(19) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} xǐhuān.*
Zhangsan and Lisi {HUXIANG/BICI} like.
'Zhangsan and Lisi like each other.'

Example (20) contains two reciprocal forms: the pronominal reciprocal contributes a discourse referent, but the adverbial reciprocal does not. The adverbial and pronominal reciprocals each contribute the same coreference and noncoreference constraints. Multiple specification of these constraints does not result in contradiction.

(20) *Zhāngsān hé Lǐsì {hùxiāng/bǐcǐ} xǐhuān bǐcǐ.*
Zhangsan and Lisi {HUXIANG/BICI} like BICI.
'Zhangsan and Lisi like each other.'

$u_1\ u_2$
$\cup u_1 = \{Zhangsan, Lisi\}$ $\cup u_2 \rightarrow \cup u_1,\ \partial(u_2 \neq u_1)$ $\cup u_2 \rightarrow \cup u_1,\ \partial(u_2 \neq u_1)$ $like(u_1, u_2)$

6. Reciprocal scope ambiguity

It is well known that reciprocals may exhibit scope ambiguities. Previous work on reciprocal scope in Mandarin is scant, and reports contradictory judgements: while Ping (1996) briefly acknowledges the existence of scope ambiguities, Xu (2008) claims (though without any examples) that only narrow scope readings are available, and Kobayashi (2020) claims that wide scope readings are available only for pronominal reciprocals. Here, we show that

in fact, narrow and wide scope readings are available for both pronominal and adverbial reciprocals.[4]

In English, 'Romeo and Juliet thought that they liked each other' has a narrow scope ("we") reading where Romeo and Juliet think: 'we like each other'. That is, each has the same thought: Romeo likes Juliet and Juliet likes Romeo. The same sentence also has a wide scope bound ("I") reading where Romeo thinks: 'I like Juliet', and Juliet thinks: 'I like Romeo', but neither of them has a belief involving mutual liking.

Turning to Mandarin, the narrow scope reading is fairly easy to access with pronominal or adverbial reciprocals in the embedded clause. However, the wide scope bound reading is hard to get for some speakers with reciprocals in the embedded clause, but is available for some speakers.

(21) *Luómìōu hé Zhūlìyè rènwéi [tāmen xǐhuān bǐcǐ].*
Romeo and Juliet think they like BICI
'Romeo and Juliet think they like each other.' (✓narrow, %wide bound)

(22) *Luómìōu hé Zhūlìyè rènwéi [tāmen {hùxiāng/bǐcǐ} xǐhuān].*
Romeo and Juliet think they {HUXIANG/BICI} like
'Romeo and Juliet think they like each other.' (✓narrow, %wide bound)

A wide scope bound reading is accessed more easily when the narrow scope reading results in a logical contradiction. In the context of a single contest with only one winner, only a wide scope reading is available in (23) and (24):

(23) *Luómìōu hé Zhūlìyè rènwéi [tāmen dǎbài-le bǐcǐ].*
Romeo and Juliet think they defeat-PFV BICI
'Romeo and Juliet think they defeated each other.'

(24) *Luómìōu hé Zhūlìyè rènwéi [tāmen {hùxiāng/bǐcǐ} dǎbài-le bǐcǐ].*
Romeo and Juliet think they {HUXIANG/BICI} defeat-PFV BICI
'Romeo and Juliet think they defeated each other.'

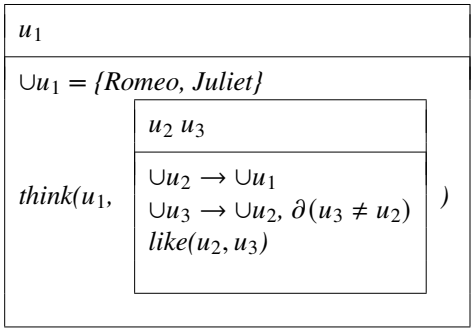
In the rest of this section, we will present our analysis to account for these scopal possibilities in Mandarin.

6.1 Narrow scope ("we") reading

We follow Haug and Dalrymple (2020) in proposing the following representation for the narrow scope reading:

[4] Our data were elicited from seven mainland Chinese speakers of Mandarin.

(25)



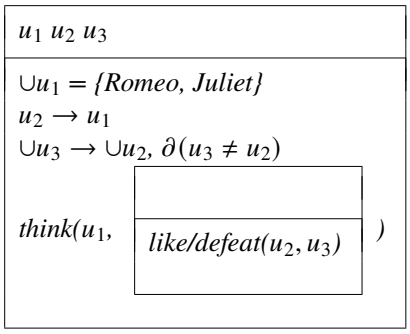
	u_1	w	u_2	u_3
s_{1a}	R	w_1	R	J
s_{1b}	R	w_1	J	R
s_{2a}	J	w_2	R	J
s_{2b}	J	w_2	J	R

According to this analysis, u_1 ranges over the individuals Romeo and Juliet. Each of Romeo and Juliet bears the *think* relation to some set of belief worlds in which there are two individuals, u_2 and u_3; u_2 ranges over the same individuals as u_1, namely Romeo and Juliet[5]; u_3 ranges over the same individuals as u_2; and in each information state, u_3 is different from u_2, and u_2 likes u_3. In the sample output information state given in (25), we assume for simplicity that Romeo has only one belief world w_1, and Juliet has one belief world w_2. All of these requirements are met; in Romeo's belief world w_1, Romeo likes Juliet and Juliet likes Romeo, and the same is true for Juliet's belief world w_2.

6.2 Wide scope bound ("I") reading

We follow Haug and Dalrymple (2020) in proposing the following representation for the wide scope bound reading:

(26)



	u_1	w	u_2	u_3
s_1	R	w_1	R	J
s_2	J	w_2	J	R

The reciprocal *each other* introduces its coreference and noncoreference requirements in the embedded DRS, but this material is lifted to the higher DRS along with the antecedent of the reciprocal. This lifting operation is not unique to this account; standard quantificational or operator-based approaches need to assume a similar operation to derive the wide scope reading. Under this analysis, u_1 ranges over the individuals Romeo and Juliet in each information state, and in each information state u_2 is coreferent with u_1. u_3 ranges over the same individuals as u_2, and in each information state, u_3 is noncoreferent with u_2. In each information state, u_1 has a belief that u_2 likes u_3. Since u_2 is coreferent with u_1 in each information state, this means that u_1 has this belief about him/herself as the subject of

[5]See Haug and Dalrymple (2020) for how anaphora interacts with distribution (in this case, over belief worlds).

like/defeat. We again assume that Romeo has only one belief world w_1, and Juliet has one belief world w_2. In the sample output information state in (26), these requirements are met; in Romeo's belief world, Romeo likes Juliet, and in Juliet's belief world, Juliet likes Romeo.

6.3 Wide scope "crossed" reading

On what we call the wide scope "crossed" reading of 'Romeo and Juliet thought that they liked each other,' Romeo thinks that Juliet likes him, and Juliet thinks that Romeo likes her, but as in the wide scope bound reading, neither of them has a belief involving mutual liking. This reading has sometimes been claimed to be unavailable (Heim et al. 1991, Dimitriadis 2000, LaTerza 2014), but naturally occurring examples are easy to find; see Dotlačil (2010), Dotlačil and Nilsen (2011), and Haug and Dalrymple (2020) for discussion. A wide scope "crossed" reading is accessed more easily given an appropriate context.

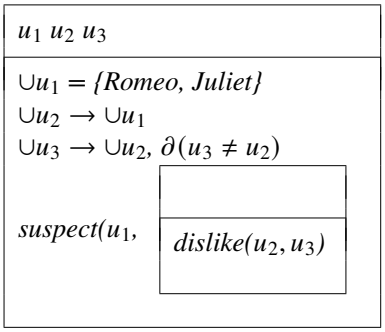
Context: Romeo and Juliet each suspected that the other disliked him/her.

(27) *Luómìōu hé Zhūlìyè huáiyí [tāmen tǎoyàn bǐcǐ].*
Romeo and Juliet suspect they dislike BICI
'Romeo and Juliet suspect that they dislike each other.' (✓wide crossed)

(28) *Luómìōu hé Zhūlìyè huáiyí [tāmen {hùxiāng/bǐcǐ} tǎoyàn (bǐcǐ)].*
Romeo and Juliet suspect they {HUXIANG/BICI} dislike (BICI)
'Romeo and Juliet suspect that they dislike each other.' (✓wide crossed)

We follow Haug and Dalrymple (2020) in proposing the following representation for this reading:

(29)



	u_1	w	u_2	u_3
s_1	R	w_1	J	R
s_2	J	w_2	R	J

Once again, the reciprocal material introduced by *each other* is lifted from the embedded DRS to the matrix DRS along with the antecedent of the reciprocal. This "crossed" reading differs from the bound reading in that the pronoun *they* receives a group identity reading instead of a bound reading. According to this analysis, u_1 ranges over the individuals Romeo and Juliet in each information state, u_2 ranges over the same individuals as u_1, and u_3 ranges over the same individuals as u_2. In each information state, u_3 is noncoreferent with u_2, and u_1 has a belief that u_2 likes u_3. These requirements are met in the sample output information state in (29): in Romeo's belief world w_1, Juliet likes Romeo, and in Juliet's belief world, Romeo likes Juliet. Note that this "crossed" reading does not arise due to any explicit

statement of noncoreference in the matrix clause. Rather, this reading describes a set of "crossed" circumstances that meets the underspecified requirements in the DRS.

6.4 Summary

The strength of the proposal presented in Haug and Dalrymple (2020) lies in its ability to dissociate the effects of reciprocal "scope" and distributivity. The narrow scope reading is derived by interpreting the reciprocal in its base position within the embedded clause. The wide scope readings are derived by lifting the reciprocal material from the embedded clause to the matrix clause. The bound and "crossed" wide scope readings in turn differ in whether the pronoun *they* is interpreted as bound or not. (A narrow scope bound reading is not possible because a bound identity reading of the pronoun *they* is unable to supply the plurality needed by the pronominal reciprocal, i.e., Romeo and Juliet each thought: "I like each other.") In this way, the proposal accounts for all the available readings in English and Mandarin.

A corollary of this proposal is that sentences like (30) and (31) are infelicitous.[6] This is because the reciprocal material that is lifted out of one conjunct necessarily imposes a wide scope reading on the other conjunct. If the other conjunct contains a collective predicate like *meet* that is incompatible with a wide scope reading, the sentence becomes ungrammatical.

(30) #They hoped that they would meet at the tennis court and defeat each other.

(31) #They suspected that they had met and betrayed each other.

We now turn to sentences with reciprocal expressions in both the matrix and embedded clauses.

7. Reciprocals in matrix and embedded clause

Reciprocal expressions describing the same reciprocal relationship can appear in both the matrix and embedded clauses, as discussed in section 3.

(32) *Luómìōu hé Zhūlìyè {hùxiāng/bǐcǐ} rènwéi [tāmen xǐhuān bǐcǐ].*
Romeo and Juliet {HUXIANG/BICI} think they like BICI
'Romeo and Juliet think they like each other.'

As expected, a wide scope reading is available for example (32): pronominal *bǐcǐ* contributes a discourse referent, a coreference requirement and a noncoreference requirement, but these requirements can be lifted to a higher DRS.

What is unexpected is the availability of a narrow scope reading for (32) given the presence of an adverbial reciprocal in the matrix clause. The adverbial reciprocal introduces a coreference and noncoreference requirement in the DRS where it appears, but these requirements can bind discourse referents in the embedded DRS. We show that this property

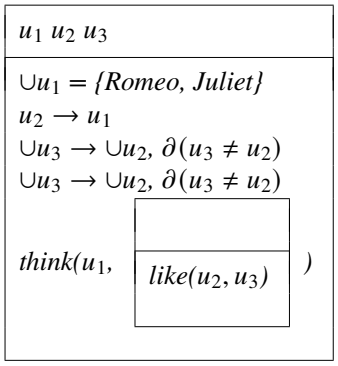
[6] We thank Yimei Xiang for bringing sentences like these to our attention.

of adverbial reciprocals accounts for the narrow scope reading without having to assume scope lowering.

Note that we do not have to stipulate any additional restrictions on which discourse referents the adverbial reciprocal is able to bind. Nothing in our account so far prevents the adverbial reciprocal from establishing anaphoric dependencies between the discourse referents in the DRS where it appears (or even non-local dependencies between the matrix subject and the embedded object, for that matter). However, these cases either result in logical inconsistency or create multiple reciprocal relations of the sort described in section 3. In this section, we focus on cases where the adverbial reciprocal binds the same discourse referents as the pronominal reciprocal, reinforcing the coreference and noncoreference requirements expressing a single reciprocal relation.

For the wide scope bound reading of (32), the adverbial reciprocal in the matrix clause contributes its coreference and noncoreference requirements in the higher DRS, while the material introduced by the (obligatory) reciprocal in the embedded clause is lifted to the higher DRS. Since both adverbial and pronominal reciprocals bind the discourse referents in the lower DRS, multiple specification of reciprocity has no effect.

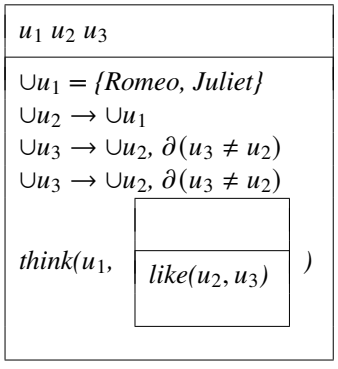
(33)



	u_1	w	u_2	u_3
s_1	R	w_1	R	J
s_2	J	w_2	J	R

The wide scope "crossed" reading for (32) is similarly obtained when the material introduced by the reciprocal in the embedded DRS is lifted to the matrix DRS. Again, both adverbial and pronominal reciprocals bind the discourse referents in the lower DRS.

(34)

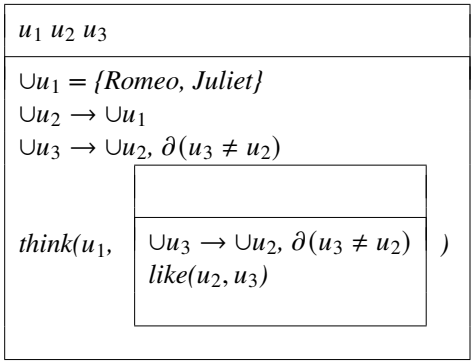


	u_1	w	u_2	u_3
s_1	R	w_1	J	R
s_2	J	w_2	R	J

If the material in the embedded DRS is not lifted, the result is effectively a "narrow" scope reading, shown in (35). The same reciprocal relationship is specified twice, once by the adverbial reciprocal in the matrix DRS, and once by the pronominal reciprocal in the

embedded DRS, which is then lifted. This does not result in any contradiction, because the adverbial reciprocal in the matrix DRS binds the same discourse referents in the embedded DRS as the pronominal reciprocal does.

(35)



	u_1	w	u_2	u_3
s_{1a}	R	w_1	R	J
s_{1b}	R	w_1	J	R
s_{2a}	J	w_2	R	J
s_{2b}	J	w_2	J	R

Crucially, on our analysis the reciprocal scopes in the clause in which it appears or in the higher clause, in both Mandarin and English. The "narrow" scope reading arises not due to scope lowering, but because of the freedom that adverbial reciprocals have to bind discourse referents in a different clause. We speculate that this freedom of anaphoric binding is why speakers have difficulty parsing such sentences, because they have to entertain several binding possibilities for the adverbial reciprocal. It should be noted, however, that the proposal that scope lowering is impossible cannot be falsified in Mandarin because an adverbial reciprocal in the matrix clause cannot appear without an accompanying reciprocal in the embedded clause, as shown above in (14).

8. Conclusion

Pronominal and adverbial reciprocals in Mandarin behave similarly to those in English in that they contribute the same coreference and noncoreference requirements. Furthermore, in both languages, these requirements can be optionally lifted to a higher clause. However, adverbial reciprocals in Mandarin are different in that they can contribute a discourse referent but need not do so. Moreover, those that do not contribute a discourse referent can bind discourse referents in the same or embedded clause. By adopting the relational account of reciprocals set out in Haug and Dalrymple (2020), we can explain the range of scopal possibilities in Mandarin without overgeneration or any additional stipulation.

This line of inquiry could be extended to include verbal affixes *hù-* and *xiāng-* that express reciprocity in Mandarin, as well as adverbial reciprocals in other languages. We leave these issues for future research.

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