Introduction to the semantics of reciprocals

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Reading Group

2 Oct 2025

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What are reciprocals?

(1)   Romeo and Juliet like **each other**.
      = Romeo likes Juliet and Juliet likes Romeo..

What are reciprocals?

(1) Romeo and Juliet like **each other**.
 = Romeo likes Juliet and Juliet likes Romeo..

(2) *Romeo likes each other.

Why study reciprocals?

Studying reciprocals could help us decide between operator-based vs relational approaches to plural predication.

Outline

Reciprocals: operator-based approach

(3) Romeo and Juliet ate a pizza.
Distributive reading: Romeo and Juliet EACH ate a pizza.

Reciprocals: operator-based approach

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$\approx$ Romeo and Juliet EACH like the other.   (Heim et al. 1991)

Reciprocals: operator-based approach

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Distributive reading: Romeo and Juliet EACH ate a pizza.

(4) Romeo and Juliet like each other.
$\approx$ Romeo and Juliet EACH like the other.   (Heim et al. 1991)

Is this the best way to capture the meaning of a reciprocal?

Outline

Reciprocal scope ambiguity

(5)   [Romeo and Juliet][1] think that they[2] like [each other][3].

Reciprocal scope ambiguity

(5) [Romeo and Juliet][1] think that they[2] like [each other][3].

Narrow scope: Romeo and Juliet think: "We like each other."

Reciprocal scope ambiguity

(5) [Romeo and Juliet]^1 think that they^2 like [each other]^3.

Narrow scope: Romeo and Juliet think: "We like each other."

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

(5)   [Romeo and Juliet]^1 think that they^2 like [each other]^3.

Narrow scope: Romeo and Juliet think: "We like each other."

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

LF: Romeo and Juliet think that they EACH like the other.

Reciprocal scope ambiguity

(6) [Romeo and Juliet][1] think that they[2] like [each other][3].

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Wide scope: Romeo thinks: "I like Juliet" and Juliet thinks: "I like Romeo."

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	u_1	u_2	u_3
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Reciprocal scope ambiguity

(6) [Romeo and Juliet][1] think that they[2] like [each other][3].

Wide scope: Romeo thinks: "I like Juliet" and Juliet thinks: "I like Romeo."

	u_1	u_2	u_3
s_1	R	R	J
s_2	J	J	R

LF: Romeo and Juliet EACH think that they like the other.

Outline

Reciprocal strength

(7) House of Commons etiquette requires legislators to address only the speaker of the House and refer to each other indirectly.

(8) "The captain!" said the pirates, staring at each other in surprise.

(Dalrymple et al. 1998)

(9)   Romeo and Juliet like each other.

Reciprocal strength

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Option 1: ≈ Romeo and Juliet EACH like the other.   (Heim et al. 1991)

Reciprocal strength

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Option 1: ≈ Romeo and Juliet EACH like the other.   (Heim et al. 1991)

Option 2: ≈ RECIP(Romeo and Juliet, like)   (Dalrymple et al. 1998)

Outline

Multiple reciprocals

(10) 罗密欧　和　朱丽叶　喜欢　彼此。
Luómìōu hé Zhūlìyè xǐhuān **bǐcǐ**.
Romeo and Juliet like BICI

'Romeo and Juliet like each other.'

Multiple reciprocals

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'Romeo and Juliet like each other.'

(11) 罗密欧　和　朱丽叶　互相　喜欢。
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Romeo and Juliet HUXIANG like

'Romeo and Juliet like each other.'

Multiple reciprocals

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　　　Luómìōu　hé　Zhūlìyè　**hùxiāng**　xǐhuān.
　　　Romeo　and　Juliet　HUXIANG　like
　　　'Romeo and Juliet like each other.'

(12)　罗密欧　和　朱丽叶　互相　喜欢　彼此。
　　　Luómìōu　hé　Zhūlìyè　**hùxiāng**　xǐhuān　**bǐcǐ**.
　　　Romeo　and　Juliet　HUXIANG　like　BICI
　　　'Romeo and Juliet like each other.'

Multiple reciprocals

(13) Romeo and Juliet each like the other.

Multiple reciprocals

(13) Romeo and Juliet each like the other.

(14) *Romeo and Juliet each like each other.

Outline

Reciprocals: relational approach

(15) [Romeo and Juliet]^1 like [each other]$_1^2$.

Reciprocals: relational approach

(15) [Romeo and Juliet]^1 like [each other]$^2_1$.

u_1 u_2
$R \oplus J(\cup u_1)$
$Like(u_1, u_2)$
$\cup u_2 = \cup u_1$
$u_2 \neq u_1$

	u_1	u_2
s_1	R	J
s_2	J	R

(15) [Romeo and Juliet]^1 like [each other]$_1^2$.

u_1 u_2
$R \oplus J(\cup u_1)$
Like(u_1, u_2)
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	u_1	u_2
s_1	R	J
s_2	J	R

The material in this section is adapted from Haug and Dalrymple (2020).
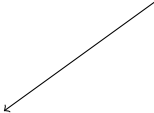
Outline

Dynamic semantics

Dynamic semantics

Evelyn
marries Waymond.

Dynamic semantics

Evelyn
marries Waymond.

Evelyn becomes
the owner of
a laundromat.

Dynamic semantics

Evelyn
marries Waymond.

Evelyn doesn't
marry Waymond.

Evelyn becomes
the owner of
a laundromat.

Dynamic semantics

Dynamic semantics

Evelyn
marries Waymond.

Evelyn doesn't
marry Waymond.

Evelyn becomes
the owner of
a laundromat.

Evelyn
becomes
a movie star.
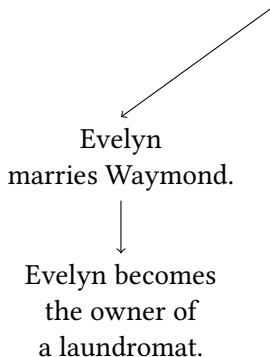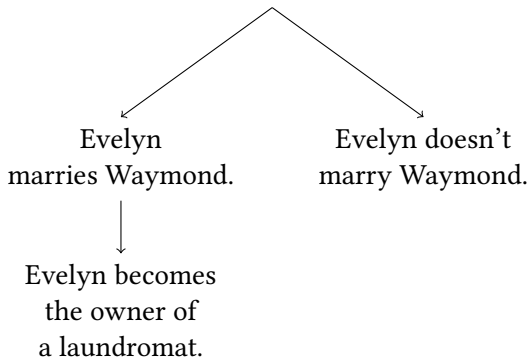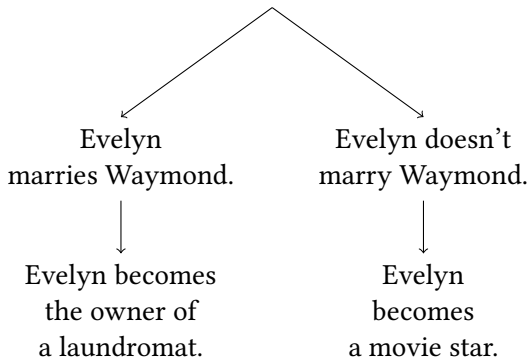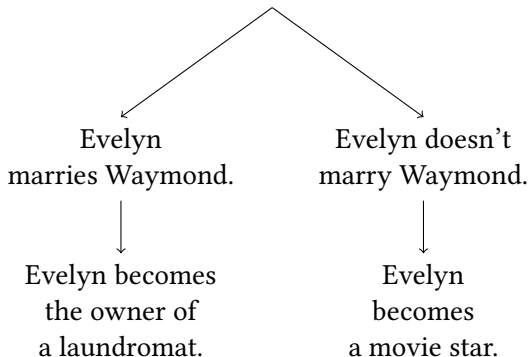
Each sentence takes us to a different possible world.

Dynamic semantics

Each sentence reduces the **context (set)** = the set of possible worlds.

$$w \quad w \quad w \quad w$$

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$$w \quad w \quad w \quad w$$

$$w \quad w \quad w \quad w$$

Dynamic semantics

Each sentence reduces the **context (set)** = the set of possible worlds.

$$
\begin{array}{cccc}
w & w & w & w \\
w & w & w & w \\
w & w & w & w \\
w & w & w & w \\
\end{array}
$$

Evelyn
marries
Waymond.

Dynamic semantics

Each sentence reduces the **context (set)** = the set of possible worlds.

Evelyn owns a laundromat.

w	w	w	w
w	w	w	w
w	w	w	w
w	w	w	w

Evelyn marries Waymond.

Dynamic semantics

Each sentence reduces the **context (set)** = the set of possible worlds.

Evelyn owns a laundromat.

w	w	w	w
w	w	w	w
w	w	w	w
w	w	w	w

Evelyn marries Waymond.

A sentence has the potential to change / update the context.

The multiverse

w_1 w w w_2

w w w w

w w w w

w w w w

The multiverse

w_1 w w w_2

w w w w

w w w w Evelyn
marries
Waymond.

w w w w

The multiverse

w_1 w w w_2

w w w w

w w w w

w w w w

Evelyn marries Waymond.

$\longrightarrow$

w_1 w w w_2

w w w w

w w w w

w w w w

The multiverse

w_1 w w w_2

w w w w

w w w w

w w w w

Evelyn
marries
Waymond.

$\longrightarrow$

w_1 w w w_2

w w w w

w w w w

w w w w
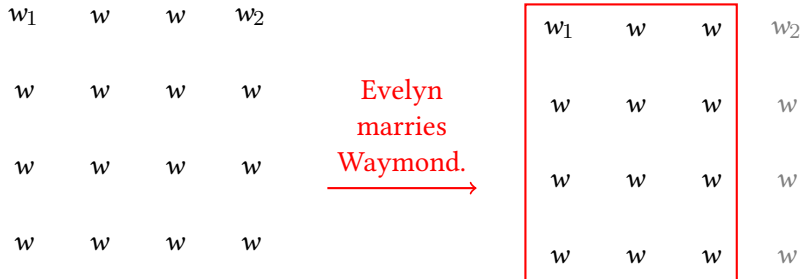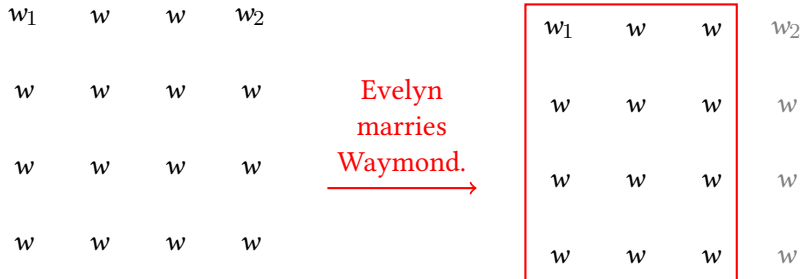
A sentence is a function that takes us from one context to another.

Dynamic semantics

Sentences introduce **discourse referents** and **conditions** on these drefs.

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(16) Evelyn marries Waymond.

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(16) Evelyn marries Waymond.

1
Evelyn marries 2

2
Waymond marries 1

Dynamic semantics

Sentences introduce **discourse referents** and **conditions** on these drefs.

(16) Evelyn marries Waymond.

1
Evelyn marries 2

2
Waymond marries 1

(17) Evelyn owns a laundromat.

Dynamic semantics

Sentences introduce **discourse referents** and **conditions** on these drefs.

(16) Evelyn marries Waymond.

1
Evelyn marries 2

2
Waymond marries 1

(17) Evelyn owns a laundromat.

1
Evelyn marries 2 owns 3

2
Waymond marries 1

3
is a laundromat

Dynamic semantics

The contribution of a sentence can be represented as a **discourse representation structure (DRS)**.

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(18) Evelyn marries Waymond.

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(18) Evelyn marries Waymond.

$u_1\ u_2$
$\text{Evelyn}(u_1)$ $\text{Waymond}(u_2)$ $\text{Marry}(u_1, u_2)$

Dynamic semantics

The contribution of a sentence can be represented as a **discourse representation structure (DRS)**.

(18) Evelyn marries Waymond.

$$\begin{array}{|l|}
\hline
u_1\ u_2 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\hline
\end{array}$$

(19) Evelyn owns a laundromat.

Dynamic semantics

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(18) Evelyn marries Waymond.

$u_1\ u_2$
$\text{Evelyn}(u_1)$ $\text{Waymond}(u_2)$ $\text{Marry}(u_1, u_2)$

(19) Evelyn owns a laundromat.

u_3
$\text{Laundromat}(u_3)$ $\text{Own}(u_1, u_3)$

Dynamic semantics

DRSs can be combined using **dynamic conjunction** (;).

(20) Evelyn marries Waymond. Evelyn owns a laundromat.

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DRSs can be combined using **dynamic conjunction** (;).

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u_1 u_2
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Dynamic semantics

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;

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Laundromat(u_3)
Own(u_1, u_3)

Dynamic semantics

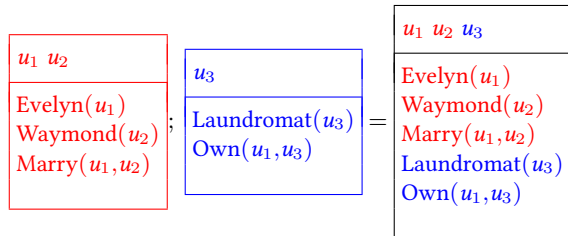DRSs can be combined using **dynamic conjunction** (;).

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$$
\begin{array}{|l|}
\hline
u_1 \ u_2 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\hline
\end{array}
;
\begin{array}{|l|}
\hline
u_3 \\
\hline
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
=
\begin{array}{|l|}
\hline
u_1 \ u_2 \ u_3 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
$$

Dynamic semantics

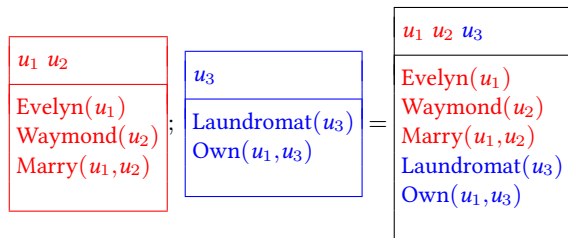DRSs can be combined using **dynamic conjunction** (;).

(20) Evelyn marries Waymond. Evelyn owns a laundromat.

$$
\begin{array}{|l|}
\hline
u_1 \ u_2 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\hline
\end{array}
\ ;\
\begin{array}{|l|}
\hline
u_3 \\
\hline
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
\ =\
\begin{array}{|l|}
\hline
u_1 \ u_2 \ u_3 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
$$

Q: Does Evelyn in the second sentence introduce its own dref?

Dynamic semantics

DRSs can handle **cross-sentential anaphora**.

(21) Evelyn$_1$ marries Waymond. She^1 owns a laundromat.

$$
\begin{array}{|l|}
\hline
u_1 \ u_2 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\hline
\end{array}
;
\begin{array}{|l|}
\hline
u_3 \\
\hline
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
=
\begin{array}{|l|}
\hline
u_1 \ u_2 \ u_3 \\
\hline
\text{Evelyn}(u_1) \\
\text{Waymond}(u_2) \\
\text{Marry}(u_1, u_2) \\
\text{Laundromat}(u_3) \\
\text{Own}(u_1, u_3) \\
\hline
\end{array}
$$
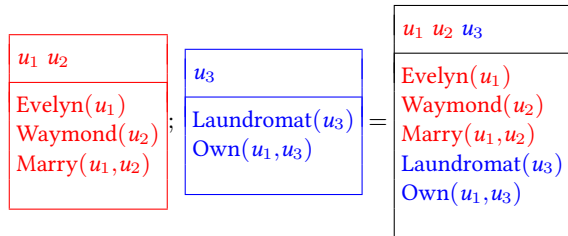
(22) [Romeo and Juliet]^1 like [each other]$_1^2$.

(22) [Romeo and Juliet]^1 like [each other]$^2_1$.

u_1 u_2
$\text{R} \oplus \text{J}(\cup u_1)$
$\text{Like}(u_1, u_2)$
$\cup u_2 = \cup u_1$
$u_2 \neq u_1$

	u_1	u_2
s_1	R	J
s_2	J	R

Outline

Reciprocal scope ambiguity

(23) Romeo and Juliet think that they like each other.

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Narrow scope: Romeo and Juliet think: "We like each other."

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(23) Romeo and Juliet think that they like each other.

Narrow scope: Romeo and Juliet think: "We like each other."

Wide scope: Romeo thinks: "I like Juliet" and Juliet thinks: "I like Romeo."

(24) Evelyn and Waymond thought they had won.

(24) Evelyn and Waymond thought they had won.

This sentence is ambiguous.

(24) Evelyn and Waymond thought they had won.
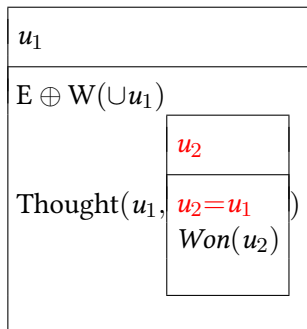
This sentence is ambiguous.

1 Evelyn and Waymond each thought: "We won."
2 Evelyn and Waymond each thought: "I won."

Excursus: plural anaphora in DRT

(25) [Evelyn and Waymond]^1 thought they$_1^2$ had won.
  Bound reading: Evelyn and Waymond each thought: "I won."

$$
\begin{array}{|l|}
\hline
u_1 \\
\hline
\mathrm{E} \oplus \mathrm{W}(\cup u_1) \\[2mm]
\mathrm{Thought}\Big(u_1, \boxed{\begin{array}{l} u_2 \\ \hline u_2 = u_1 \\ Won(u_2) \end{array}}\Big) \\
\hline
\end{array}
$$

$$
\begin{array}{c|cc}
 & u_1 & u_2 \\
\hline
s_1 & E & E \\
s_2 & W & W \\
\end{array}
$$
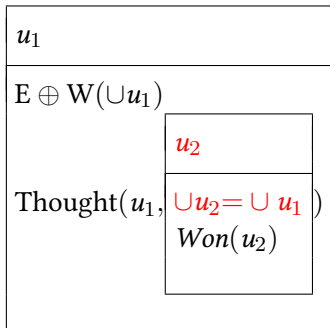
Excursus: plural anaphora in DRT

(26) [Evelyn and Waymond]^1 thought they$_1^2$ had won.
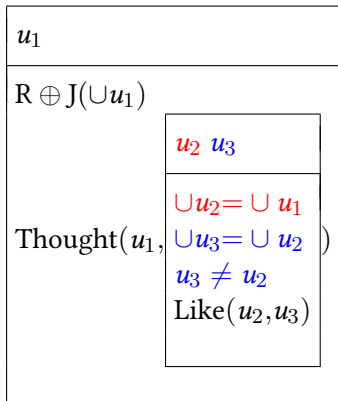Group identity reading: Evelyn and Waymond each thought: "We won."

$$\boxed{\begin{array}{l} u_1 \\ \hline \mathrm{E} \oplus \mathrm{W}(\cup u_1) \\[1em] \mathrm{Thought}(u_1, \boxed{\begin{array}{l} u_2 \\ \hline \cup u_2 = \cup u_1 \\ \mathit{Won}(u_2) \end{array}}) \end{array}}$$

	u_1	u_2
s_1	E	$E \oplus W$
s_2	W	$E \oplus W$

Reciprocal scope ambiguity

(27) [Romeo and Juliet][1] think that they[2] like [each other][3].
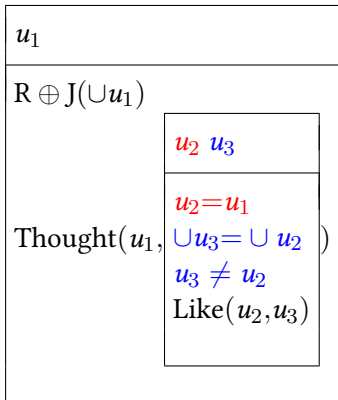Narrow scope: Romeo and Juliet think: "We like each other."

u_1

$R \oplus J(\cup u_1)$

Thought$(u_1,$

$u_2 \ u_3$

$\cup u_2 = \cup u_1$
$\cup u_3 = \cup u_2$
$u_3 \neq u_2$
Like(u_2, u_3)

$)$

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

Reciprocal scope ambiguity

(28) [Romeo and Juliet][1] think that they[2] like [each other][3].

Not possible:

$$
\boxed{
\begin{array}{l}
\boxed{u_1} \\[4pt]
\text{R} \oplus \text{J}(\cup u_1) \\[4pt]
\text{Thought}(u_1,
\boxed{
\begin{array}{l}
u_2 \ u_3 \\[4pt]
u_2 = u_1 \\
\cup u_3 = \cup u_2 \\
u_3 \neq u_2 \\
\text{Like}(u_2, u_3)
\end{array}
}
)
\end{array}
}
$$

	u_1	u_2	u_3
s_1	R	R	J
s_2	J	J	R

Reciprocal scope ambiguity

(29) [Romeo and Juliet][1] think that they[2] like [each other][3].
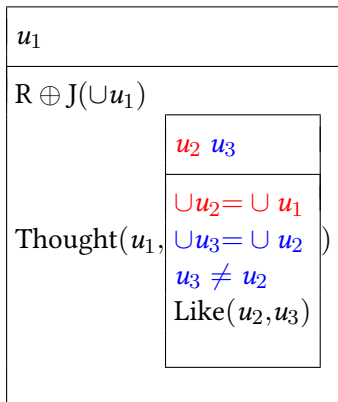Wide scope: Romeo thinks: "I like Juliet" and Juliet thinks: "I like Romeo."

u_1 u_2 u_3

$R \oplus J(\cup u_1)$
$u_2 = u_1$
$\cup u_3 = \cup u_2$
$u_3 \neq u_2$

Thought(u_1, Like(u_2, u_3))

	u_1	u_2	u_3
s_1	R	R	J
s_2	J	J	R

Reciprocal scope ambiguity

(30) [Romeo and Juliet][1] think that they[2] like [each other][3].
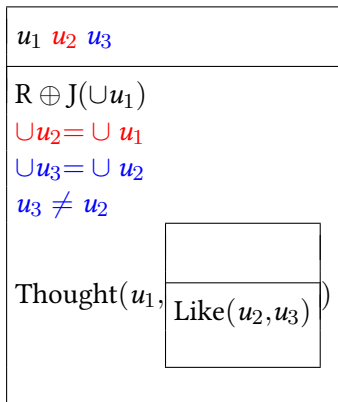"Crossed reading": Romeo thinks: "Juliet likes me" and Juliet thinks:
"Romeo likes me."

$$
\begin{array}{|l|}
\hline
u_1 \\
\hline
\text{R} \oplus \text{J}(\cup u_1) \\
\hline
\text{Thought}(u_1, \boxed{\begin{array}{l} u_2\ u_3 \\ \hline \cup u_2 = \cup u_1 \\ \cup u_3 = \cup u_2 \\ u_3 \neq u_2 \\ \text{Like}(u_2, u_3) \end{array}}) \\
\hline
\end{array}
$$
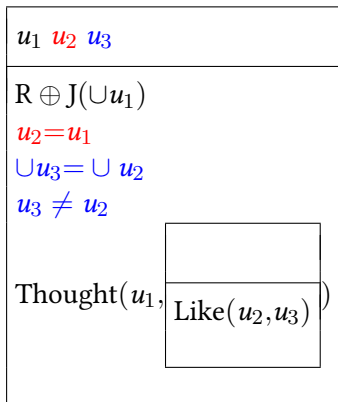
	u_1	u_2	u_3
s_1	R	J	R
s_2	J	R	J

Reciprocal scope ambiguity

(30) [Romeo and Juliet][1] think that they[2] like [each other][3].
"Crossed reading": Romeo thinks: "Juliet likes me" and Juliet thinks: "Romeo likes me."

u_1 u_2 u_3

$R \oplus J (\cup u_1)$
$\cup u_2 = \cup u_1$
$\cup u_3 = \cup u_2$
$u_3 \neq u_2$

$\text{Thought}(u_1, \boxed{\text{Like}(u_2, u_3)})$

	u_1	u_2	u_3
s_1	R	J	R
s_2	J	R	J

Outline

Reciprocal strength

(31) House of Commons etiquette requires legislators to address only the speaker of the House and refer to each other indirectly.

(32) "The captain!" said the pirates, staring at each other in surprise.

<div align="right">(Dalrymple et al. 1998)</div>

Reciprocal strength

(31) House of Commons etiquette requires legislators to address only the speaker of the House and refer to each other indirectly.

(32) "The captain!" said the pirates, staring at each other in surprise.

<div align="right">(Dalrymple et al. 1998)</div>

$u_1\ u_2$
Legislators$(\cup u_1)$
Refer-to(u_1, u_2)
$\cup u_2 = \cup u_1$
$u_2 \neq u_1$

$u_1\ u_2$
Pirates$(\cup u_1)$
Stare-at(u_1, u_2)
$\cup u_2 = \cup u_1$
$u_2 \neq u_1$

Outline

漦

Multiple reciprocals

(33) 罗密欧　和　朱丽叶　互相　喜欢　彼此。
Luómìōu hé Zhūlìyè **hùxiāng** xǐhuān **bǐcǐ**.
Romeo and Juliet ʜᴜxɪᴀɴɢ like ʙɪᴄɪ
'Romeo and Juliet like each other.'

Multiple reciprocals

(33)

罗密欧	和	朱丽叶	互相	喜欢	彼此。
Luómìōu	hé	Zhūlìyè	**hùxiāng**	xǐhuān	**bǐcǐ**.
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'Romeo and Juliet like each other.'

$$
\begin{array}{|l|}
\hline
u_1 \ u_2 \\
\hline
R \oplus J(\cup u_1) \\
\cup u_2 = \cup u_1 \\
u_2 \neq u_1 \\
\cup u_2 = \cup u_1 \\
u_2 \neq u_1 \\
\text{Like}(u_1, u_2) \\
\hline
\end{array}
$$

Summary

Summary

- Studying reciprocals could help us decide between operator-based vs relational approaches to plural predication.

Dalrymple, Mary, Makoto Kanazawa, Yookyung Kim, Sam Mchombo, and Stanley Peters. 1998. Reciprocal expressions and the concept of reciprocity. *Linguistics and Philosophy* 21:159–210.

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