Situating Reciprocity[*]

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Abstract

Dalrymple, Kanazawa, Kim, Mchombo and Peters (henceforth DKKMP) have shown in a series of recent papers that the concepts of reciprocity expressed by the English phrases *each other*, and *one another*, vary systematically from context to context (Dalrymple et al. (1994), Kim and Peters (1995), Dalrymple et al. (in preparation)). These researchers proposed a principle called the Strongest Meaning Hypothesis (SMH) to account for which concept among a surprisingly wide variety *each other* expresses in a given context.

Their work focuses on the question of what content the reciprocal contributes to utterances of sentences containing it. They do not present a full lexical meaning for the reciprocal and compositional semantic rules with which one can derive the meaning of any reciprocal sentence compositionally. Although their logical formulation of denotations and the principle SMHdoes implicitly contain a quasi-extensional semantic account of reciprocals—extensional semantic rules suffice to combine the extension of any given reciprocal concept with its scope, and the result with the antecedent—explicitly formulating this account reveals that it is not really extensional, because the choice of which reciprocal concept to use depends according to SMH on consistency of the rules' output with other information (not merely on truth or falsity).

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I will show how to formulate a situated meaning of the reciprocal which incorporates the effect of the SMH in making the concept of reciprocity expressed depend on the circumstances of utterance. Although no extensional account is can be given, I will demonstrate that situation semantics enables the formulation of compositional semantic rules for deriving the meaning of reciprocal sentences.

The context of utterance, which DKKMP exploit in their analysis, comprises various situations: the background situation, common ground situation, discourse situation, and utterance situation. Each of these influences what concept of reciprocity the reciprocal expresses. I examine closely which situations surrounding a reciprocal utterance, including the described situation, exert an influence and how they do so. I will show that different situations DKKMP lumped together under the heading of context exert differing influences on the concept of reciprocity expressed by an utterance, and I consequently strengthen DKKMP's arguments that reciprocal expressions are not ambiguous—they do not have more than one meaning, among which a speaker may choose at will. The complexities of *each other* make it difficult both to demonstrate that there is only one meaning of the reciprocal and to formulate it precisely, although the phenomenon of an expression's single meaning determining what concept a given utterance of it expresses in a highly situation-dependent fashion is familiar from indexical expressions like *here*.

1 DKKMP's Analysis

Research by DKKMP among others revealed definite boundaries on the wide variety of concepts of reciprocity expressible by *each other*. Each permitted concept of reciprocity has a polyadic quantifier of type (1,2) as its extension (i.e., a certain type of relation between sets of objects and binary relations on objects). The SMH requires *each other* to express whichever permitted concept gives the larger reciprocal utterance containing it the logically strongest interpretation that is consistent with certain information determined by the context of utterance and with what the rest of the reciprocal utterance means.

Dalrymple et al. (in preparation) use two dimensions of variation to schematize the five concepts of reciprocity attested in their corpora. The first dimension pertains to how relation R should cover its domain A; one of the following three requirements is applicable:

1. each pair of objects in A is required to stand in the relation R directly (FUL);
2. each pair of objects in A is required to stand in the relation R at least indirectly (LIN); or
3. each single object in A is required to stand in the relation R to at least one other one (TOT).

More formally:

$$\mathrm{FUL}(A,R) \quad \overset{\mathrm{df}}{\leftrightarrow} \quad R\restriction A = A \times A$$

$$\begin{array}{rcl} \mathrm{LIN}(A,R) & \overset{\mathrm{df}}{\leftrightarrow} & (R\restriction A)^{+} = A\times A \\ \mathrm{TOT}(A,R) & \overset{\mathrm{df}}{\leftrightarrow} & \mathrm{dom}(R\restriction A) = A \end{array}$$

where $R\restriction A$ is $R\cap(A\times A)$, and $(R\restriction A)^{+}$ is the transitive closure of $R\restriction A$. Since the truth value of a reciprocal statement never depends on whether or not an object bears the relation R to itself, the schema for concepts of reciprocity should disregard pairs whose first member is the same as the second. Thus DKKMP utilize $\mathrm{FUL}\backslash I$, $\mathrm{LIN}\backslash I$ and $\mathrm{TOT}\backslash I$:

$$\begin{array}{rcl} \mathrm{FUL}\backslash I(A,R) & \overset{\mathrm{df}}{\leftrightarrow} & \mathrm{FUL}(A,R\cup I) \text{ and } |A|\geq 2 \\ \mathrm{LIN}\backslash I(A,R) & \overset{\mathrm{df}}{\leftrightarrow} & \mathrm{LIN}(A,R\cup I) \text{ and } |A|\geq 2 \\ \mathrm{TOT}\backslash I(A,R) & \overset{\mathrm{df}}{\leftrightarrow} & \mathrm{TOT}(A,R\setminus I) \text{ and } |A|\geq 2 \end{array}$$

where I is the identity relation, adding the requirement that the set A have at least two members.

The second dimension of variation concerns how the reciprocal's scope determines the argument R of $\mathrm{FUL}\backslash I$, $\mathrm{LIN}\backslash I$ and $\mathrm{TOT}\backslash I$: whether the relation R which reciprocity requires to hold between objects in the domain A is in actuality the extension of the reciprocal's scope, or is obtained from the extension by ignoring the direction in which the scope relation holds (i.e., by adding inverse pairs).

$$R^{\vee} \overset{\mathrm{df}}{=} R\cup R^{-1}$$

Thus Dalrymple et al. (in preparation) define the schema $\textsc{recip}^{\sharp\dagger}$ of concepts of reciprocity as:

$$\textsc{recip}^{\sharp\dagger}(A,R) \overset{\mathrm{df}}{\leftrightarrow} \textsc{recip}^{\sharp}(A,R^{\dagger})$$

where $\textsc{recip}^{\sharp}$ is one of $\mathrm{FUL}\backslash I$, $\mathrm{LIN}\backslash I$ and $\mathrm{TOT}\backslash I$, and $R^{\dagger}$ is either R or $R^{\vee}$. Semantic rules are supposed always to set R equal to the extension of the reciprocal's scope and, when the reciprocal's antecedent is set-denoting, A equal to the set denoted.

This schema $\textsc{recip}^{\sharp\dagger}$ has six non-equivalent instances, which are partially ordered according to logical strength as shown in the following diagram, where arrows represent logical implication for arbitrary A and R.

(1)

$$\begin{tikzcd}
 & & \text{SR: } \textsc{ful}\backslash I(A,R) \arrow[dl] \arrow[dr] & \\
 & \text{IR: } \textsc{lin}\backslash I(A,R) \arrow[dl] \arrow[dr] & & \text{[1]: } \textsc{ful}\backslash I(A,R^\vee) \arrow[dl] \\
\text{OWR: } \textsc{tot}\backslash I(A,R) \arrow[dr] & & \text{IAR: } \textsc{lin}\backslash I(A,R^\vee) \arrow[dl] & \\
 & \text{IAO: } \textsc{tot}\backslash I(A,R^\vee) & &
\end{tikzcd}$$

In the substantial sample of data DKKMP examined empirically,[1] the reciprocal was interpreted as expressing the logically strongest of these six concepts which is consistent with the meanings of the reciprocal's scope and antecedent as well as with certain relevant nonlinguistic information. More precisely, what is interpreted in the strongest way is not the reciprocal per se (i.e., $\textsc{recip}^{\sharp\dagger}$) but the combination of it with its antecedent and scope. Thus they hypothesized that the parameters of the linguistic meaning of reciprocal expressions are set by the following general principle.

Strongest Meaning Hypothesis (SMH): A reciprocal sentence S can be used felicitously in a context c, which supplies nonlinguistic information I relevant to the reciprocal's interpretation, provided the set $\mathcal{S}_c$ has a member that entails every other one:

$\mathcal{S}_c = \{p \mid p$ is consistent with I and p is an interpretation of S obtained by interpreting the reciprocal as one of the six quantifiers in (1)$\}$

In that case, the use of S in c expresses the logically strongest proposition in $\mathcal{S}_c$.

2 Situation Semantics of Reciprocals

To capture in a compositional semantics the insights about reciprocals recounted in the preceding section, I exploit the fact that situation semantics treats the meaning of any expression as relating situations in which the expression is uttered to the content that the utterance of it expresses. From this perspective, I seek an analysis of the reciprocal expression *each other*'s meaning as a constraint that relates situations surrounding a reciprocal utterance to the concept of reciprocity which is the reciprocal's content in that utterance.

A key insight is the recognition that utterances of a reciprocal expression have a scope and an antecedent, and they occur in situations that provide information constraining the interpretation of the utterance of the reciprocal,

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[1] The authors examined 1740 examples from the 'Hector' Corpus and 1579 examples from the New York Times.

as DKKMP discussed. So the 'input' of the meaning constraint I seek will be a situation u of utterance (or, as we shall eventually see, several situations surrounding the utterance) in which *each other* is used with a scope ϕ and a set-denoting antecedent α, and in which the 'contextual information pertinent' to the reciprocal is q. The situation u will also pin down the resource situation s_α and content P_α of the included utterance of α, the described situation s_ϕ and content $\sigma(x, y)$ of the included utterance of ϕ, and the described situation s of the reciprocal utterance which comprises the reciprocal, its scope and its antecedent.

These ingredients include what are needed to connect with the preceding section. The reciprocal's domain argument is the set $A = \mathrm{Ext}(T_\alpha)$ and its scope argument is the relation $R = \mathrm{Ext}(T_\phi)$, where $T_\alpha = [z|s_\alpha \models \langle\langle P_\alpha, z\rangle\rangle]$ and $T_\phi = [x, y|s_\phi \models \sigma(x, y)]$.

So the 'output' of the reciprocal's meaning constraint is the concept $\textsc{recip}^{\sharp\dagger}$ of reciprocity, if there is one, which satisfies the conditions

- $p^{\sharp\dagger} \in \mathcal{S}_u$ and
- for all $p' \in \mathcal{S}_u$, $p^{\sharp\dagger} \Rightarrow p'$,

where

1. $p^{\sharp\dagger} = (s \models \langle\langle \textsc{recip}^{\sharp\dagger}, A, R\rangle\rangle)$ and
2. $\mathcal{S}_u = \{p' | \exists^{\sharp\dagger}(p' = p^{\sharp\dagger} \wedge q \not\Rightarrow \neg p')\}$.[2]

Semantic rules for compositionally assigning meanings to sentences, including any sentence containing the reciprocal *each other*, can use this lexical meaning of the reciprocal straightforwardly. These rules must have some standard means of scoping quantifiers, including those that bind two variables, like *each other*. (For an illustration of the one-variable case, see (Gawron and Peters, 1990), for example.) They must also have some standard means of associating a quantifier with its domain when the corresponding expressions are separated syntactically (e.g., in the case of so-called floated quantifiers and of adverbs of quantification). Whatever these means are, the lexical meaning for *each other* in the preceding paragraph provides exactly the right 'hooks' to connect with them, viz. the parameters ϕ for scope and α for domain, and the associated parameters for situations and content. The full paper will explain in more detail how specific compositional rules relate any circumstances of use of a reciprocal sentence to the information content of that utterance.

3 Deconstruction of Context: Background, Common ground, and other Circumstantial Situations

In simple cases, like

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[2] If more than one $\textsc{recip}^{\sharp\dagger}$ yields the same logically strongest $p^{\sharp\dagger}$ in $\mathcal{S}_u$ (for instance, because R is inherently symmetric and thus the value of the parameter † is immaterial), then any of these concepts of reciprocity can be taken as the constraint's 'output'. If $\mathcal{S}_u$ has no logically strongest member, then use of the reciprocal in the situation u is deviant.

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

the strongest consistent interpretation of the reciprocal statement comes from the strongest concept of reciprocity, namely Strong Reciprocity (SR), because nothing in the meaning of the scope (being required to refer indirectly) or of the antecedent (House of Commons legislators), nor any contextually pertinent information contradicts this interpretation. In more scientifically interesting cases like

(3) As the preposterous horde crowded around, waiting for the likes of Evans and Mike Greenwell, **five Boston pitchers sat alongside each other**: Larry Andersen, Jeff Reardon, Jeff Gray, Dennis Lamp and Tom Bolton.

the corresponding interpretation is inconsistent with the facts that (baseball) pitchers are people and people have two sides, which are determined to be pertinent in the context. It being impossible for every two pitchers in a set of five to be sitting alongside each other at a single time, the strongest interpretation of statement (3) which is consistent with these facts is the one that comes from taking the reciprocal to express the concept of Intermediate Reciprocity (IR). Therefore the information content of this statement is that any two of the five pitchers are connected by a chain of other ones such that each is sitting alongside the next.

The fact that pitchers are people is probably part of the **background** situation of most utterances of the sentence *Five pitchers sat alongside each other*. The fact that people have only two sides, in contrast, is part of the **common ground** of many, but definitely not all utterances of this clause. The latter fact is not part of the background of utterance, and most certainly not part of the linguistic meaning of *person* or *pitcher*. This difference is important in determining the content of reciprocal statements because the common ground fluctuates more freely and rapidly in a dialogue than the background does. There are clear cases where the reciprocal clause is interpreted with SR rather than IR as the concept expressed by *each other*. For instance,

(4) It is physically impossible for five pitchers to sit alongside each other

would normally be understood as making a true claim. So here the reciprocal is interpreted as SRrather than IR; the latter would yield a false claim, as shown by the truth of the *New York Times*'s report (3). A listener interpreting statement (4) quite naturally recognizes that he is meant to act as if the fact that people have only two sides were no part of the common ground shared with the speaker. In contrast, facts that would normally be in the in the background of a conversation are not readily treated as irrelevant to the interpretation of reciprocals.

It is the relative flexibility of common ground that gives the appearance of reciprocal expressions, and thus reciprocal sentences, being ambiguous, i.e., having different meanings among which a speaker can choose at will. For example, different utterances of sentence

(5) The inspector found peach fruit flies at four different locations within a mile of each other.

can express different propositions:

1. Any two of the locations are within a mile of each other (so all lie within a circle one-mile in diameter).
2. Any two of the locations are connected by a chain of others along which each location is within a mile of the next (so you can reach any of the locations from any other without ever traveling more than a mile in which you don't visit any of the four locations).
3. Each of the locations has another within one mile of it (so no location is isolated, i.e. surrounded by a one-mile radius circle containing none of the other locations).

The reason is actually not that (5) is ambiguous, which it is not—any more than *He isn't here* is. Rather, an utterance of sentence (5) expresses whichever one of these propositions it does because the common ground of the speaker and hearer includes some fact such as

1. that the inspector was systematically searching a grid of fly traps,
2. that the inspector was sampling fly traps along a curvilinear route, or
3. that the inspector was checking traps at random locations.

A speaker can control the interpretation of (5) by controlling the common ground she shares with the listener, and only to the extent she can control the common ground.

The full paper will examine a larger range of data, showing that the background, common ground, discourse and even described situations of a reciprocal utterance provide information that plays somewhat different roles in determining what concept of reciprocity *each other* expresses.

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