Reciprocal Verbs as Collective Predicate Concepts

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We present a new analysis of reciprocal verbs, supported by experimental evidence challenging previous proposals. In a relatively simple example of lexical reciprocity, *A&B dated* means the same as *A dated B and B dated A*. A long-standing puzzle concerns the relation between reciprocity of intransitive verbs like *date* and symmetry of the transitive entry: *A dated B = B dated A*. Some authors have conjectured that all reciprocal verbs are symmetric in this way. However, verbs like *collide* and *hug* are an outstanding challenge for this conjecture: sentences like *A&B hug* invite a reciprocal interpretation, but transitive *hug* is clearly not symmetric, as seen in "the drunkard hugged the lampost"[3]. Here we show that non-symmetric verbs like *hug* are only "pseudo-reciprocal". Following a recent proposal by Winter[12], we argue that there is no logical rule connecting sentences like *A&B hug* to "symmetric situations" where A hugs B and B hugs A. Instead, we propose that verbs like *hug* and *collide* denote *collective predicate concepts* in the lexicon. The relation between the intransitive entry and the transitive entry is described using "soft" typicality preferences. Our results reveal two preferences for categorization with such collective concepts, which are typical though not logically necessary. This allows implementing our proposal using a standard threshold theory of categorization.[6]

For an intransitive-collective verb P_1 ("reciprocal") and a transitive verb P_2, previous analyses[1,2,5,7,11] postulated a uniform entailment: from *A&B-*P_1 to the reciprocal scheme *A-*P_2*-B and B-*P_2*-A*. Such entailments are derived using a general lexical rule connecting P_1 and P_2. For the verbs *collide/hug*, the unary predicate $\boldsymbol{c_1/h_1}$ and binary predicate $\boldsymbol{c_2/h_2}$ lead to analyses (1)-(2), connected by a rule (3).

(1) a. [[A&B collide]] = $\exists e.\boldsymbol{c_1}(e,A\oplus B)$ b. [[A&B hug]] = $\exists e.\boldsymbol{h_1}(e,A\oplus B)$

(2) a. [[A collides with B]] = $\exists e'.\boldsymbol{c_2}(e',A,B)$ b. [[A hugs B]] = $\exists e'.\boldsymbol{h_2}(e',A,B)$

(3) a. $\forall A,B\ \forall e.\boldsymbol{c_1}(e,A\oplus B) \rightarrow \exists e' \boldsymbol{\leq} e.\boldsymbol{c_2}(e',A,B)$ b. $\forall A,B\ \forall e.\boldsymbol{h_1}(e,A\oplus B) \rightarrow \exists e' \boldsymbol{\leq} e.\boldsymbol{h_2}(e',A,B)$

(3a) requires that any "collective" event *e* with a plural participant $A\oplus B$ contains two "transitive" sub-events with participants *A* and *B* in both argument orders (for $A\oplus B=B\oplus A$). Consequently, (1a) is expected to entail both "A collides with B" and "B collides with A". Similarly, (1b) is expected to entail "A hugs B" and "B hugs A". However, we show that for many predicates such entailments don't hold. E.g. in Fig.1a, many Dutch speakers judge "the man and the woman collide" true but "the woman collides with the man" false, and similarly in Fig.1b for "the girl and the woman hug" and "the woman hugs the girl". Thus, given the momentary situations in Fig.1a/b, those speakers make different inferences about collective events and transitive events, showing pattern (4).

(4) Fig.1a $\rightarrow$ A&B *collide* Fig.1a $\not\rightarrow$ B *collides with* A Fig.1b $\rightarrow$ A&B *hug* Fig.1b $\not\rightarrow$ B *hugs* A

This contradicts (3), which requires *B collides with/hugs A* to be inferred from any situation where *A&B collide/hug* is inferred. According to (3), when a speaker is given a depicted situation and a sentence like *A&B collide/hug*, she is expected to check whether the two sub-situations in the picture support the corresponding transitive sentences. If she sees that one of the sub-situations does not support the corresponding binary statement, her judgement is expected to be that the collective sentence is false.

Additionally, we also found that collective sentences as in (1a-b) are less commonly judged as true in situations as in Fig.2a-b, where the "passive agent" doesn't look emotionally involved.

We conjecture that this preference for "involvement" and patterns like (4) are commonly attested with speakers, falsifying rules like (3). Instead, we hypothesize that intransitive verbs like *collide* and *hug* denote *primitive concepts* of collective predicates in a speaker's lexicon. When a group argument is categorized as an agent of such a verb, there are only typical "sub-entailments"[4] regarding what the

group members do, e.g. whether each of them is *hugging* or *colliding with* the other member(s) of the group. Typicality is central for analyzing lexical reciprocity, since the threshold for categorizing an event as belonging to a reciprocal verb may vary from speaker to speaker.[6,7] We propose that similar to other categorization tasks with natural verb concepts (e.g. which events count as *smiling*?), it is typicality preferences, not logical rules, that determine whether speakers categorize an event using reciprocal verbs like *hug* and *collide*. Specifically, for such reciprocal predicates P_1, we identify two typical preferences for any group argument G in an event e:

(5) The event e is ***typical*** for P_1 ***proportionally to*** two values:

Participation (P)= number of pairs in G satisfying the binary relation P_2=

$$|\{\langle x,y\rangle \in G\times G: x\neq y \ \&\ \exists e' \leq e.\ P_2(e',x,y)\}|$$

E.g. the more "transitive collisions/hugs" within G in e, the more typical e becomes as collective collision/hug of G. In (1): a reciprocal event with two transitive collisions/hugs is more typical than an asymmetric event, but (1) doesn't categorically require two transitive collisions/hugs.

Collective Intentionality (CI) = strength of evidence that G's members have in e a "shared intention/joint attention/shared belief/collective emotion"[9,10] about the relevant act.

In sum: symmetric participation plus CI is preferred to asymmetric participation plus CI, which is preferred to asymmetric participation without CI. This explains the observations on Figures 1-2 using Hampton's threshold theory of categorization:[6] in Fig.1a-b, CI has strong evidence, hence the typicality of *A&B collide/hug* is above the categorization threshold of many speakers despite non-maximal participation. In Fig.2, participation remains as in Fig.1, but negative evidence for CI reduces the typicality of *A&B collide/hug* to levels that are below many speakers' threshold. Our experiment tested this theory.

Materials. Eight Dutch reciprocal verbs were tested (*botsen*-"collide", *knuffelen*-"hug", *praten*-"talk", *vechten*-"fight", *spreken*-"speak", *kletsen*-"chat", *roddelen*-"gossip", *appen* "send-whatsApp-messages-to-(each-other)") on two similar drawings, each featuring two people. In both scenarios, one person visibly performs the transitive act on the other, while the other person is passive. In the *target-scenario*, the passive person looks emotionally involved (Fig.1), but not in the *control-scenario* (Fig.2). For each target-scenario, we tested truth-value judgements on two sentences, e.g:

(6) a. de man en de vrouw botsen "the man and the woman collide" (Collective)
b. de vrouw botst tegen de man "the woman collides with the man" (Binary)

(7) a. het meisje en de vrouw knuffelen "the girl and the woman hug" (Collective)
b. de vrouw knuffelt het meisje "the woman hugs the girl" (Binary)

A pretest revealed no effect of order between such items, thus we gave each participant all 8 target-scenarios with both sentences. Further, we added 30 fillers (clearly true, or vague) to balance true/false reactions. For control-scenarios, we only tested truth-value judgements on the collective sentences.

Procedure. 48 Dutch speakers (37 female, age *M*= 23) indicated whether they considered a sentence true or false in a depicted scenario. Trials were presented on a screen in a pseudo-random order. Control-scenarios were all presented at the end of the experiment.

Results. The table gives proportions of participants who judged the collective sentence true (col+) and the binary sentence true (bin+) in the target scenarios. The "col+bin-" column indicates individual responses in target scenarios, detailing proportions of participants who judged the collective sentence true but the binary sentence false. The reverse measures of "col-bin+" participants were uniformly zero. The "ctrl.col+" column gives proportions of "true" judgements on the collective sentence in the control-scenario.

verb	col+	bin+	col+ bin-	ctrl. col+
hug	79%	31%	48%	19%
collide	98%	2%	96%	65%
appen	94%	8%	85%	44%
talk	46%	4%	42%	13%
speak	69%	13%	56%	33%
chat	98%	17%	81%	27%
gossip	90%	6%	83%	46%
fight	73%	15%	58%	23%

Discussion. For all 8 verbs in the target-scenarios, collective sentences were very often judged "true", while the binary sentences were not. Importantly, for all 8 verbs, many participants (42-96%, *M*=69%) showed a "col+bin-" behavior in the target-scenario, i.e. judged the collective sentence "true" and the binary sentence "false". This is unexpected according to rules like (3): if a sentence $A\&B\text{-}P_1$ logically entails $A\text{-}P_2\text{-}B$ *and* $B\text{-}P_2\text{-}A$, it is unclear why speakers sometimes judge the antecedent "true" while

judging one of the consequent's conjuncts "false". We conclude that while symmetric participation is *preferred* for the verbs we tested, it is not *logically* required. Considering the mean acceptance rates of the collective sentences in the control-scenarios, we see a substantial decline compared to the target-scenarios (from *M*=81% to *M*=34%). Furthermore, many of the speakers who gave "col+" reactions in the target-scenario changed their judgement in the control-scenario and considered the collective sentence false (24-66%, *M*=40%). This is explained by the lack of evidence for CI in the control-scenario, which for many speakers led to typicality values below the threshold level. Together, these results falsify logical rules like (3) and support our typicality-based account. Furthermore, our findings constitute new empirical support for the theoretical framework proposed in Winter (2016)[12].

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References [1] Carlson 1998, Thematic roles, in Rothstein, *Events and Grammar*. [2] Dimitriadis 2008, The event structure of irreducibly symmetric reciprocals, in Dölling, *Event Structures*. [3] Dong 1971, A note on conjoined noun phrases, in Zwicky, *Studies out in left field*. [4] Dowty 1987. Collective predicates, ESCOL3. [5] Gleitman et. al. 1996, Similar, and similar concepts, *Cognition*. [6] Hampton 2007, Typicality, *Cognitive Science*. [7] Kerem et al. 2009, Typicality, *SALT19*. [8] Rubinstein 2009, Groups, *NELS38*. [9] Schweikard et al. 2013, Collective intentionality, in Zalta, *Stanford Encyclopedia of Philosophy*. [10] Searle 1990, Collective intentions, in Cohen, *Intentions in Communication*. [11] Siloni 2012, Reciprocal verbs, *NLLT*. [12] Winter 2016, The reciprocity-symmetry generalization, EISS11.