

Typicality Effects and the Logic of Reciprocity

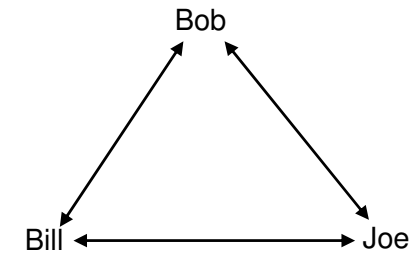
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SALT19 – April 4, 2009 – Ohio State University

Background: The Reciprocal Question

Bob, Joe, and Bill *see* one another.

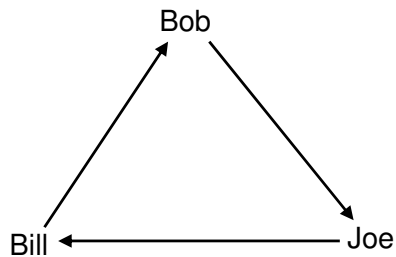
→ **Each one** sees **each** of the others.



Background: The Reciprocal Question

Bob, Joe, and Bill *are staring at* one another.

→ **Each one** is staring **at one of** the others.



Background: The Reciprocal Question

Bob, Joe, and Bill *are following* one another.

→ **Each one** is following **or is being** followed.



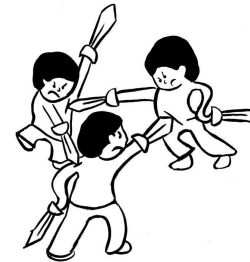
Previous Accounts of Reciprocals

- ❑ **Weak reading (+ strengthening):**
Langendoen (1978), Roberts (1988), and others.
- ❑ **Strongest Meaning Hypothesis:**
 - Dalrymple et al (1998): strongest interpretation *in the context*.
 - Sabato & Winter (2005): strongest interpretation *consistent with meaning of predicate*.

SMH is too strong

Bob, Joe and Bill *are stabbing* one another.

OK



But stronger interpretation is possible!

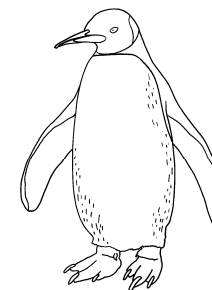


For such predicates, ~**35%** of subjects would prefer the **weaker** interpretation.

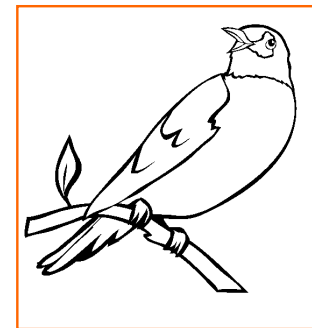
Where is the problem?

- ❑ According to all accounts, reciprocal interpretation is influenced by context.
- ❑ Specifically, by the meaning of the predicate in the scope of the reciprocal: *see, stare at, follow*, but also *stab*.
- ❑ Thus, *lexical semantics* of predicates is inseparable from analyzing reciprocals.
- ❑ Not all cardinality distinctions in the lexicon are sharp; some come in shades of grey

Typicality Effects



More typical



Bird

$C_{\text{BIRD}}(\text{Penguin}) < C_{\text{BIRD}}(\text{Robin})$

Typicality Effects

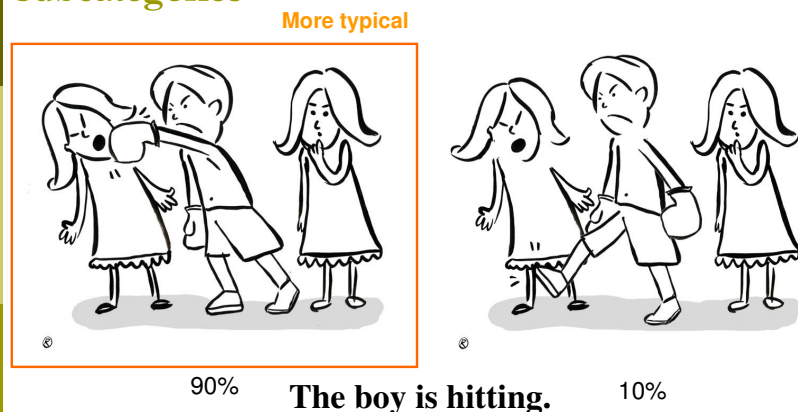
- Different members of a category are empirically graded as better or worse examples of the concept.
 - Categorization time
 - Conscious grading
- Found with many different concepts ('RED', 'EVEN NUMBER', 'HELPFUL'...)
- **Typicality function** of a concept CON is a function c_{con} from the relevant category to $[0,1)$.

Relational Concepts

- Predicates are mentally represented by *relational concepts*.
- Given the ubiquity of typicality, we expect relational concepts to exhibit typicality effects as well.

Typicality Effects in Relational Concepts

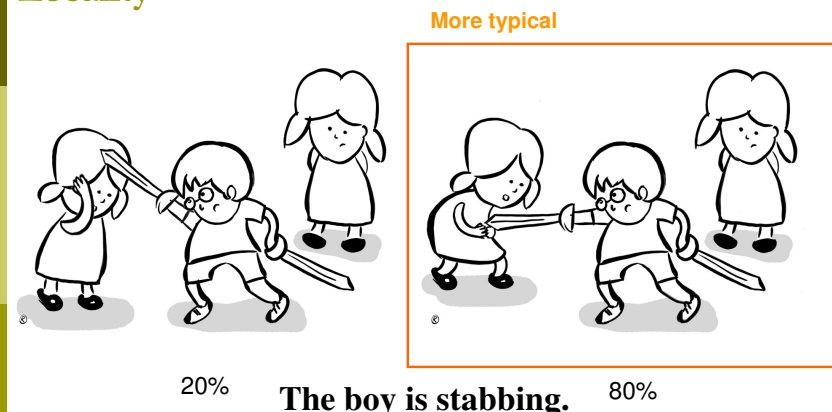
Subcategories



$$C_{HIT}(\text{Punch}) > C_{HIT}(\text{Kick})$$

Typicality Effects in Relational Concepts

Locality

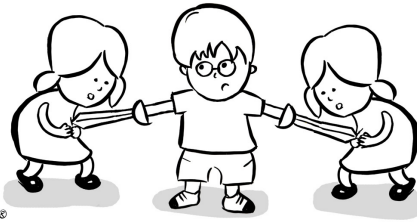
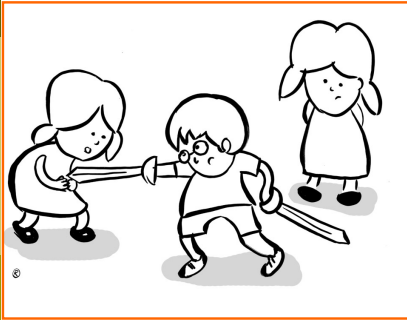


$$C_{STAB}(\text{In-head}) < C_{STAB}(\text{In-stomach})$$

Typicality Effects in Relational Concepts

Cardinality

More typical



88% **The boy is stabbing.** 12%

$$C_{\text{STAB}}(\text{Single}) > C_{\text{STAB}}(\text{Multiple})$$

Maximal Typicality Hypothesis

A reciprocal is consistent with models in which no tuple can be added to the reciprocated n -ary relation **without reducing its typicality relative to the relational concept.**

Bob, Joe, and Bill *are stabbing* one another.



Typical
Not reciprocal



Typical
Reciprocal

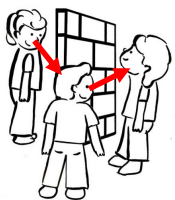


Nontypical
Reciprocal

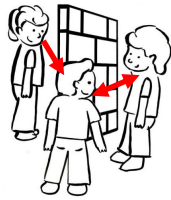
Maximal Typicality Hypothesis

A reciprocal is consistent with models in which no tuple can be added to the reciprocated n -ary relation **without reducing its typicality relative to the relational concept.**

Bob, Joe, and Bill *see* one another.



Typical
Not reciprocal



Typical
Not reciprocal



Typical
Reciprocal

Maximal Typicality Hypothesis

A reciprocal is consistent with models in which no tuple can be added to the reciprocated n -ary relation **without reducing its typicality relative to the relational concept.**

Bob, Joe, and Bill *are following* one another.



Typical
Reciprocal



Nontypical
Reciprocal

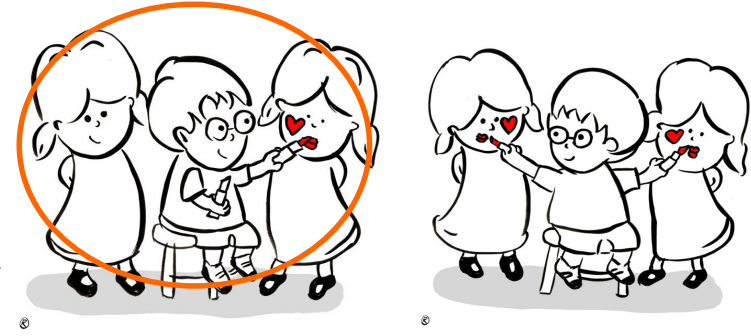


Experimental Support for MTH

- Each set tested verbs for typicality and for reciprocal meaning.
- We then examined the correlation between typicality and reciprocal meaning in each set.
- Each experiment was conducted on 50 university students that are native Hebrew speakers.

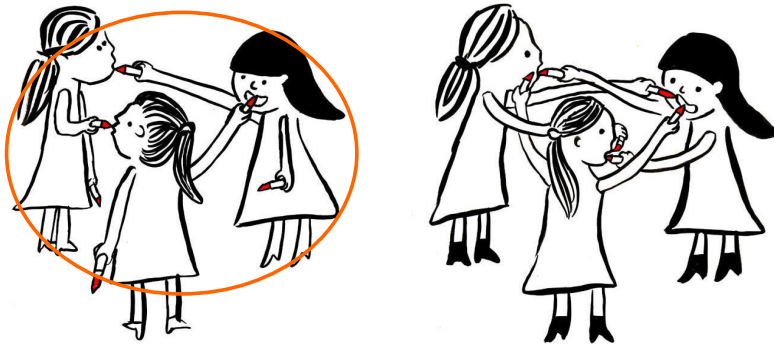
Experiment 1^T: Forced Choice

Subjects were asked to draw a circle around the picture that best depicts the accompanying sentence.



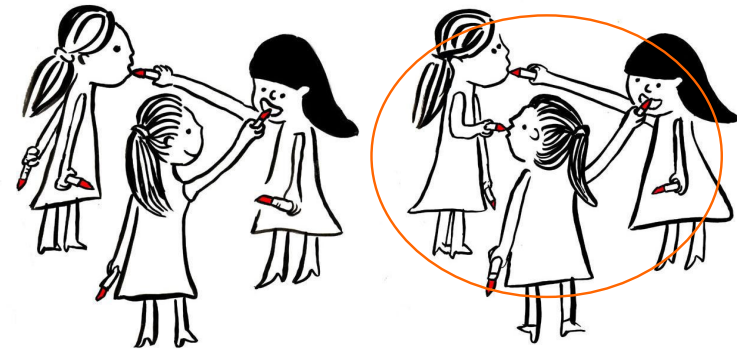
Ha-Yeled Me'aper
(The boy is applying make-up)

Experiment 1^{R-i}: Forced Choice



The girls are applying make-up to each other.

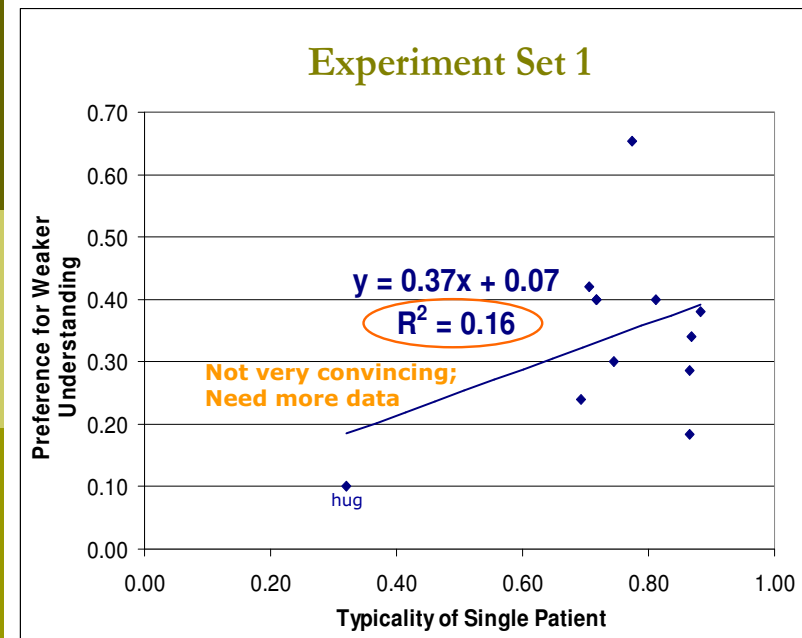
Experiment 1^{R-ii}: Forced Choice



The girls are applying make-up to each other.

Experiment Set 1: Results

- Most predicates tested typically prefer single patients (**70%-90%**);
stab, wipe, pinch, paint, scrape, shake ...
- Some predicates show nearly equal preference for circle and full reciprocal interpretation (~**35|65**)
- One predicate, *hug*, does not typically prefer single patient interpretation (only **32%**).
- hug* also shows **90%** preference for full reciprocal interpretation.
- For all predicates: 95-100% preference for circle over path reciprocal interpretation.



Experiment 2^T: Sentence Completion

Subjects were presented with an incomplete sentence and asked to choose the completion that sounds best to them:

Mary pointed at ... the boy / the boys.

Experiment 2^R: Textual Entailment

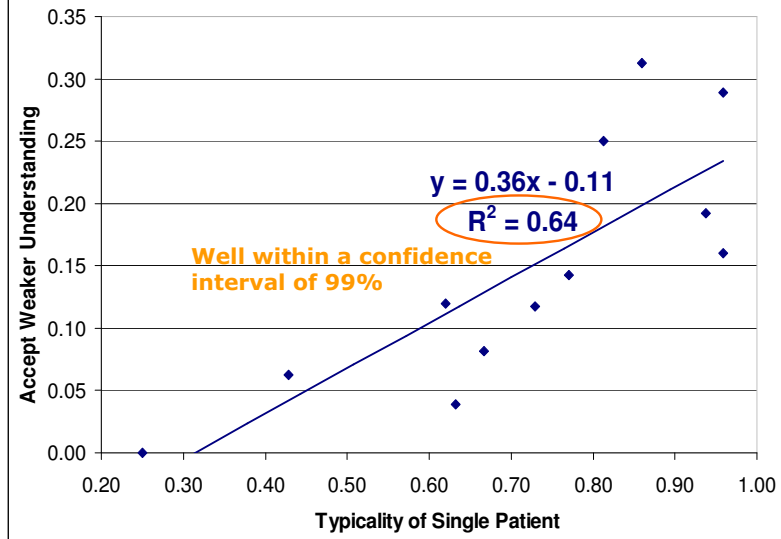
Subjects were presented with a reciprocal sentence and asked if a second sentence is entailed by it:

Mary, Jane, and Sue are pointing at each other.

Can you infer that Mary is pointing at Sue?

Yes / No

Eventive Verbs in Experiment Set 2



Summary

- ❑ Experiment set 1, diagram-based task, results were not evenly distributed, only 'hug' does not typically prefer single patient.
- ❑ Experiment set 2, textual tasks, allow for more selection in predicates; wide variance in typicality preferences.
- ❑ Despite different tasks, both show similar typicality-reciprocity correlation; **0.36**

Conclusions

- ❑ *Rejection* of weaker interpretations correlates with *typicality retain* in stronger interpretations.
- ❑ *Acceptance* of weaker interpretations correlates with typicality reduction in stronger ones.
- ❑ Supports for MTH: A reciprocal is consistent with models in which no tuple can be added to the n -ary relation without reducing its typicality relative to the relational concept.