Resolving Quantity and Informativeness Implicature in Indefinite Reference

Till Poppels & Roger Levy

2016 Annual Meeting

The Phenomenon

(1) a. The man broke a finger. +> his **OWN** finger
b. The man injured a child. +> *not* his own child (**OTHER'S**)

OTHER'S

The man injured a child.
The man broke a nose.
…
The father injured a son.
The man broke a finger.

OWN

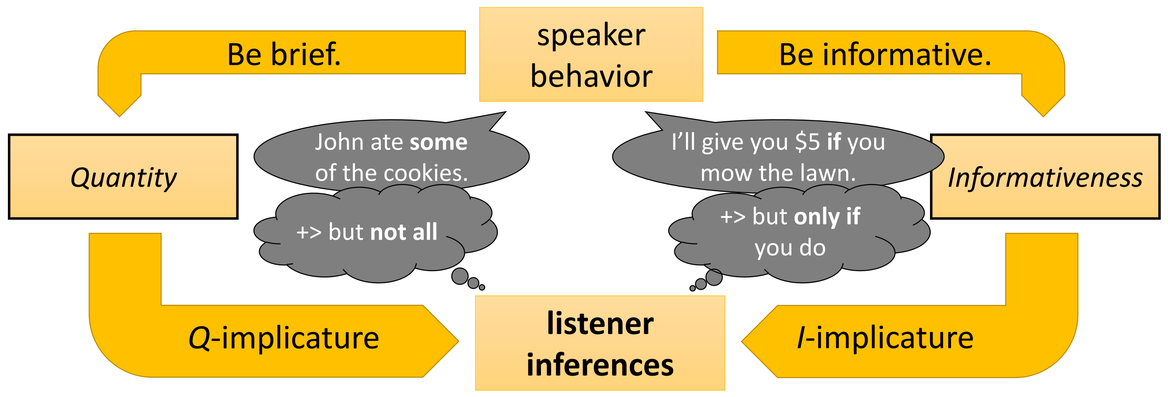
The ***X V***-ed a ***Y***.
?

Research Question

What determines the **direction** and **strength** of inferences about the semantically underspecified relation between X and Y?

Atlas & Levinson (1981); Levinson (2000)

Gricean Inferences

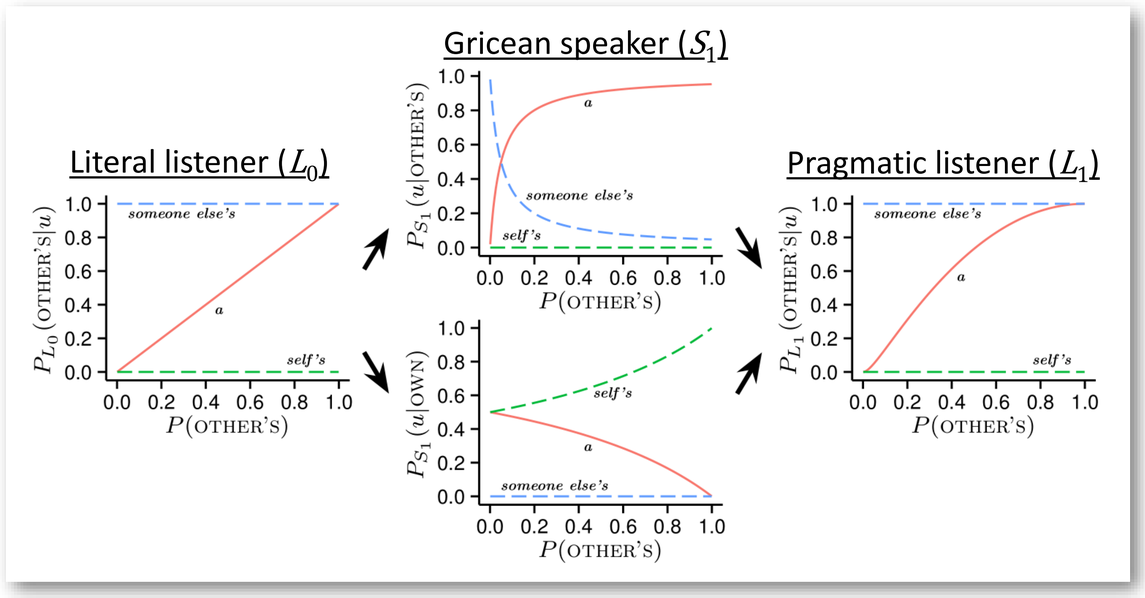


Centrality of *Quantity* and *Informativeness* widely recognized:

- Horn (1984): as antinomic interpretational forces
- Searle (1965): as the principle of "maximum illocutionary ends with minimum phonetic effort"
- Zipf (1949): as speaker's economy and listener's economy

Grice (1957; 1975)

Iterative Reasoning



Frank & Goodman (2012)

The Rational Speech Act Model

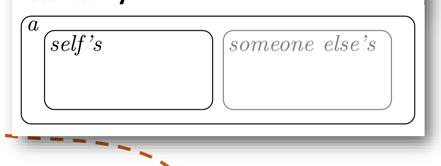
Pragmatic listener:
$$P_{L_1}(m|u) \propto P_{S_1}(u|m)P(m)$$

Gricean speaker:
$$P_{S_1}(u|m) \propto \exp(\lambda[\log(P_{L_0}(m|u)) - D(u)])$$

Literal listener:
$$P_{L_0}(m|u) \propto \mathcal{L}(u,m)P(m)$$

Scalar pressure

If utterance u is compatible with meaning m, any alternative u' exerts scalar pressure on u away from m to the extent that u' is **more precise** and **less costly** than u.



Modeling assumptions

utterance (u)	$\mathcal{L}(u,$ OWN)	$\mathcal{L}(u,$ OTHER'S)	$D(u)$
a	1	1	1
self's	1	0	1
someone else's	0	1	4

Frank & Goodman (2012)

Methods

The man broke a finger.
The man broke a nose.
The man injured a child.
The father injured a child.
The nurse broke a finger.
The man shaved a leg.
The woman shaved a leg.
The m…

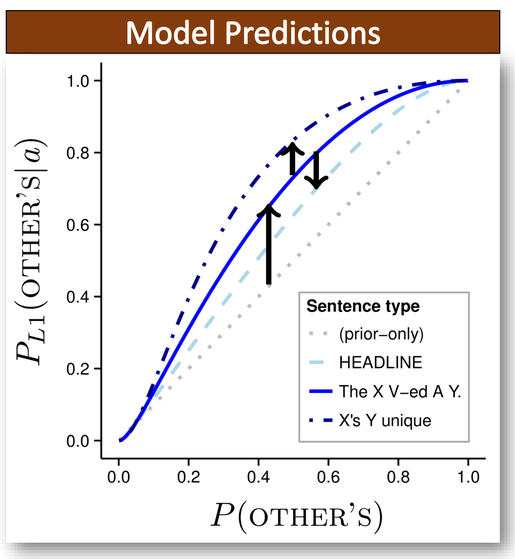
Man broke finger.
Man broke nose.
Man injured child.
Father injured child.
Nurse broke finger.
Man shaved leg.
Woman shaved leg.

- 53 *X-V-Y* sentence pairs
- 2-alternative forced choice task
- event priors normed separately
- mixed logit regression

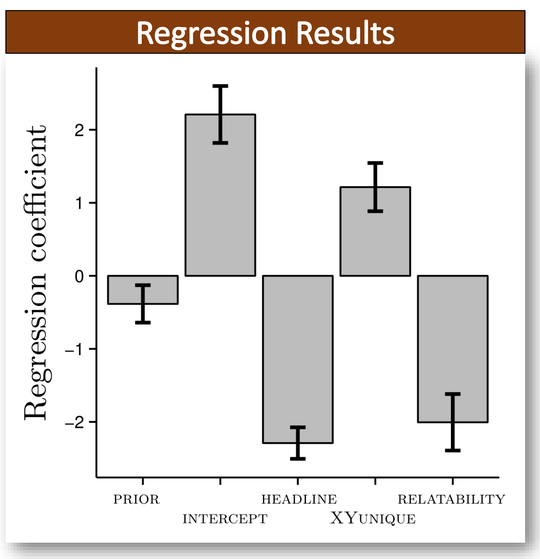
```
response ~ prior + XYuniqueness + relatability + headline + (1 + headline | item)
```

Predictions & Results

Model Predictions



Regression Results



1. Interpretations should track **priors**
2. Overall *Q*-implicature towards **OTHER'S**
3. Reduced *Q*-implicature in **HEADLINE** versions (*X V*-ed *Y*.)
4. Amplified *Q*-implicature when *X*'s *Y* is **unique**
5. Pressure towards OWN when *X* and *Y* are highly "**relatable**"

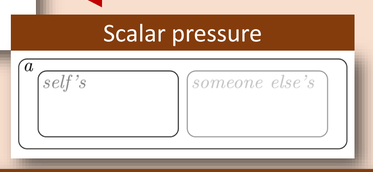
Discussion

The HEADLINE effect

utterance (u)	$\mathcal{L}(u,$ OWN)	$\mathcal{L}(u,$ OTHER'S)	$D(u)$
$\emptyset$	1	1	0
self's	1	0	1
someone else's	0	1	4

Man injured child.

Scalar pressure



Lowering the cost of the ambiguous utterance reduces the scalar pressure from both alternatives, pulling interpretations back towards OWN.

Felicity conditions as 2-place cost function

has only 1
The man broke a nose. vs. The man broke a finger.
has more than 1

Hawkins (1991):
a brightest student
a US president

2-place cost functions (Jäger, 2012):
$$D(a, \text{OWN}) > D(a, \text{OTHER'S})$$
…if *X*'s *Y* is unique!

The effect of relatability

The **man** injured a child. +> OTHER'S
The **father** injured a child. +> OWN

The man broke a **cup**. +> OTHER'S
The man broke a **finger**. +> OWN

Compare:
+> of that car
- I almost bought a **car** today but the **engine** was too noisy.
- The manager **fired** the employee who **came in late** 7 days in a row.
+> causal link

- Non-intentionalist inferences likely play an important role in language comprehension. (cf. Cohen & Kehler's **conversational elicitures**)
- Can be embedded in iterative reasoning to produce **focal-point effects**. (Schelling, 1960)

Clark (1975); Prince & Cole (1981); Cohen & Kehler (submitted)

No effect of the prior?

A common assumption is that **intention priors** can be captured through **event priors**. But likely events are not always likely to be talked about, and the most remarkable events are often highly unlikely. Since listeners are inferring intentions, not events, we technically need intention priors, which are difficult to estimate empirically.

Future research should…

- …test RSA predictions cross-linguistically: some "ingredients" are **language-specific** (e.g. alternative set; felicity conditions), others are **invariant** across languages (e.g. prior probabilities; relatability).
- …further explore the relatability effect, and the role of *Informativeness* and non-intentionalist inferences in language comprehension.

{tpoppels | rlevy}
@ucsd.edu

References

Atlas, J., & Levinson, S. (1981). It-clefts, informativeness and logical form: radical pragmatics (revised standard version). *Radical Pragmatics*.
Clark, H. (1975). Bridging. In *Proceedings of the 1975 workshop on Theoretical issues in natural language processing*. Stroudsburg, PA, USA: Association for Computational Linguistics.
Cohen, J. & Kehler, A. (submitted). Conversational Elicitures.
Frank, M. C., & Goodman, N. D. (2012). Predicting pragmatic reasoning in language games. *Science*, *336*(6084), 998–998.
Grice, H. P. (1957). Meaning. *The Philosophical Review*, 377–388.
Grice, H. P. (1975). Logic and conversation. *1975*, 41–58.
Hawkins, J. A. (1991). On (in)definite articles: implicatures and (un)grammaticality prediction. *Journal of Linguistics*, *27*(02), 405.
Hirschberg, J. (1985). A Theory of Scalar Implicature (Natural Languages, Pragmatics, Inference). *Dissertations Available from ProQuest*.
Horn, L. R. (1984). Toward a New Taxonomy for Pragmatic Inference: Q-based and R-based Implicatures. In D. Schiffrin (Ed.), *Meaning, Form, and Use in Context* (pp. 11–42). Georgetown University Press.
Horn, L. R. (2004). Implicature. In L. R. Horn & G. Ward (Eds.), *Handbook of pragmatics* (pp. 3–28). Blackwell Publishing Ltd.
Jäger, G. (2012). Game theory in semantics and pragmatics, in C. Maienborn, P. Portner & K. von Heusinger (eds.), Semantics. *An International Handbook of Natural Language Meaning*, Vol. 3, Berlin: de Gruyter, 2487-2516.
Levinson, S. C. (2000). *Presumptive meanings: The theory of generalized conversational implicature*. MIT Press.
Prince, E. F., & Cole, P. (1981). Toward a taxonomy of given-new information (pp. 223–255).
Schelling, T. C. (1960). *The Strategy of Conflict*. Harvard University Press.
Zipf, G. (1949). Human behavior and the principle of least effort.