Processing of Scalar Implicatures

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A scalar implicature

Ellen to Kyle: “You got some of the gumballs!”

Conversational implicature: Kyle did not get all of the gumballs.

i. Contextual premise: Ellen and Kyle know that Kyle could get up to 13 gumballs.

ii. Contextual premise: Ellen can but Kyle cannot see how many gumballs came out of the gumball machine.

iii. Assume that Ellen is cooperative and obeys the maxims of quality and quantity.

iv.

v.

vi.
A scalar implicature

Ellen to Kyle: “You got **some** of the gumballs!”

*Conversational implicature:* Kyle did not get **all** of the gumballs.

i. *Contextual premise:* Ellen and Kyle know that Kyle could get up to 13 gumballs.

ii. *Contextual premise:* Ellen **can** but Kyle **cannot** see how many gumballs came out of the gumball machine.

iii. Assume that Ellen is cooperative and obeys the maxims of quality and quantity.

iv. Then she will assert what is maximally relevant, informative and true.

v. The proposition $p$ that Kyle got all of the gumballs is more informative in this context than the proposition $q$ that Kyle got some of the gumballs.

vi. Therefore, Ellen must lack sufficient evidence for $p$

vii. By (ii), she must lack evidence because it is false
Goals for today

1. Give you an idea on how humans might process these scalar implicatures
2. Demonstrate the importance of the set of alternative utterances in pragmatic reasoning

Ellen to Kyle: “You got some of the gumballs!”

*Conversational implicature*: Kyle did not get all of the gumballs.

i. *Contextual premise*: Ellen and Kyle know that Kyle could get up to 13 gumballs.

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iii. Assume that Ellen is cooperative and obeys the maxims of quality and quantity.

iv. Then she will assert what is maximally relevant, informative and true.

v. **The proposition** \( p \) **that Kyle got all of the gumballs** is more informative in this context than the proposition \( q \) **that Kyle got some of the gumballs**.

vi. Therefore, Ellen must lack sufficient evidence for \( p \)

vii. By (ii), she must lack evidence because it is false
3. Give you an overview of methods in psycholinguistics
Generalized Conversational Implicature and Particularized Conversational Implicature

- Generalized Conversational Implicatures (GCI)
  - are assumed to arise in the same way independent of a particular context

  You got some of the gumballs
  $\sim$ You didn’t get all of the gumballs

Grice (1975)
Generalized Conversational Implicature and Particularized Conversational Implicature

- Particularized Conversational Implicatures (PCI)
  - tend to arise only in specific contexts and depend on the question under discussion (QUD)

  A: What on earth has happened to the roast beef?
  B: The dog is looking very happy.
  \[\rightsquigarrow\] The dog ate the roast beef.

Grice (1975)
Generalized Conversational Implicature and Particularized Conversational Implicature

• Scalar implicatures are usually considered to arise independent of context

  • Generalized Conversational Implicature

Grice (1975)
Processing Scalar Implicatures

• “Literal first” hypothesis
  • Listeners first compute the literal meaning of *some* (which includes the meaning of *all*)
  • $[[\text{some}]] = \{<A,B> : |A \cap B| \geq 1\}$
  • The implicature *not all* is computed after the literal meaning
Processing Scalar Implicatures

• “Default” hypothesis
  • Given that scalar implicatures arise in almost all contexts, it could be that listeners infer some but not all by default
  • Would reduce overall processing effort!
Predictions of the two accounts

<table>
<thead>
<tr>
<th></th>
<th>Literal First</th>
<th>Default</th>
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<tbody>
<tr>
<td>some but not all</td>
<td></td>
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Method 1: Visual World Paradigm
Method 1: Visual World Paradigm

“Click on the beaker”
Method 1: Visual World Paradigm

"Click on the beaker"
Evidence for “Literal First”

“Point to the girl that has some of the socks”

Huang and Snedeker (2009)
Evidence for “Literal First”

- Commands with *all*
  - “Point to the girl who has all of the soccer balls”
  - Participants looked at the target \(200-400\text{ms}\) after hearing *all*

- Commands with number
  - “Point to the girl who has two of the soccer balls”
  - Target fixation after \(200-400\text{ms}\)

- Commands with *some*
  - Target fixation after \(1000-1200\text{ms}\) after hearing *some*
Evidence for “Default”

Click on the girl who has [some of the balls]/[all of the balloons]
Evidence for “Default”

- Participants fixated their gaze on the target as fast for utterances with *some* as for utterances with *all*
Potential explanations

- Huang and Snedeker (2009) included number terms but Grodner et al. (2010) did not

- Set sizes in Grodner et al. were slightly larger than in Huang and Snedeker (2009)
Hypotheses

• For small numbers, the exact number is a better alternative to *some* and this alternative interferes with the processing of the scalar implicature

• This effect increases if number terms are made explicit as part of the experiment
Gumball paradigm

“You got some of the gumballs”

Degen and Tanenhaus (2015)
Method 2: Mechanical Turk Experiments

- Click on the fork
Method 2: Mechanical Turk Experiments

How natural was the statement as a description of the scene?

Very unnatural 1 2 3 4 5 6 7 Very natural

FALSE
Experiment 1: Naturalness ratings

“You got none of the/all of the/some of the/some gumballs”

Degen and Tanenhaus (2015)
Experiment 1: Naturalness ratings

“You got some gumballs”

Degen and Tanenhaus (2015)
Experiment 1: Naturalness ratings

"You got some gumballs"

[Graph showing the mean naturalness across different numbers of gumballs, with a peak at 6 gumballs and a decrease afterwards.]
Experiment 1: Naturalness ratings

Degen and Tanenhaus (2015)

“You got some gumballs”

Number of gumballs

Mean naturalness

Degen and Tanenhaus (2015)
Experiment 1: Naturalness ratings

“You got some gumballs”

Degen and Tanenhaus (2015)
Experiment 1: Naturalness ratings

"You got some gumballs"

Degen and Tanenhaus (2015)
Experiment 1: Naturalness ratings

• Some is seen as unnatural for small sets

• Does this have something to do with the availability of number terms?

Degen and Tanenhaus (2015)
Experiment 2: Naturalness ratings with numbers

**Quantifiers:**
- some
- all of the
- some of the
- none of the
- one of the
- two of the
- three of the
- ...
- twelve of the

Degen and Tanenhaus (2015)
Experiment 2: Naturalness ratings with numbers

“You got some gumballs”

Ratings for small sets are lower when numbers are present!

Degen and Tanenhaus (2015)
What about processing?

• Experiments 1 and 2 established that some is unnatural when used with low numbers

• Does naturalness predict ease of processing?
Experiment 3: Judgements

Quantifiers:
- some
- all of the
- some of the
- none of the
- one of the
- two of the
- three of the
- ...
- twelve of the
Experiment 3: Judgements

• Differences:

  • In the lab

  • Participants provided YES/NO answers using buttons

  • Participants heard a “ka-ching” sound before the gumballs dropped into the lower chamber

  • Time from hearing the sentence to response was measured

Degen and Tanenhaus (2015)
Experiment 3: Judgements

Processing of sentences with some is slower when some is less natural

Degen and Tanenhaus (2015)
Conclusions

• Naturalness and availability of alternatives predicts the processing complexity of *some*

• Processing of scalar implicatures seems more complex than distinction between “Literal-first” and “Default” account
Follow-up: Eye-tracking experiment

Degen and Tanenhaus (2016)

You got some of the orange gumballs
Pragmatic inference in online processing

Pick up the big duck.

Reference resolution via contrastive inference (Quantity-2 maxim)

Size contrast between only one pair of objects makes pre-nominal modification felicitous for that pair (overinformative otherwise)

Sedivy et al. (1999)
Pragmatic inference in online processing

Sedivy et al. (1999)