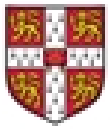
ZENTRUM FÜR ALLGEMEINE SPRACHWISSENSCHAFT



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Implicatures and Modified Numerals

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Implicatures and unmodified numerals

- Unmodified numerals possess ‘at least’ and ‘exact’ readings
  - “John has three children – in fact he has five”
  - Claimed that exact reading could arise from implicature

  - Semantics: *n* = ‘at least *n*’
  - “There are *n* people” (vs. “There are *n*+1 people”)

  +> ‘It is not the case that there are at least *n*+1 people’

  → ‘There are exactly *n* people’

- On this account, (bare) numerals give rise to SIs

Modified numerals and no implicatures?

- "more/fewer than *n*" (Fox and Hackl 2006)
  "at least/most *n*" (Krifka 1999)

  "John has more than three children"
  +> It is not true that John has more than four children (?)
  → John has exactly four children (?!)

- Counterintuitive
- Robustly fails with untrained participants (Geurts et al. 2010)
- Claim: "more than *n*" etc. fail to enter into predicted scale
  <*more than n*, *more than n+1*, …>

Implicature failure vs. pragmatic restrictions

- "more than 100" !+> "not more than 101"
  - "More than 100 people got married today"

- Yet "more than 100" +> *something…*
  - ??"More than 100 students attend this university"
  - Restriction not attributable to semantic considerations alone…
  - …suggesting that some kind of pragmatic enrichment should be available here

- What's the restriction/enrichment?

Proposed restriction 1: Granularity

- Different levels of reporting quantities
- Characterised by density of representation points (Krifka 2009)

  The distance from Amsterdam to Vienna is 965km / 1000km

- For numerals, typically related to roundness (Jansen and Pollmann 2001)
  - Major granularity levels include tens, hundreds, thousands…
  - Exceptions in e.g. time domain (24 hours/25 hours)

Proposed restriction 1: Granularity

- Preference posited for coarse-grained representations (Krifka 2009; Solt, Cummins & Palmović in prep.)
  - Round numbers more frequent (Jansen and Pollmann 2001)
  - Round numbers convey approximations (Dehaene 1997 i.a.)
- If true, suggests implicatures from modified numerals should be *restricted by granularity considerations*
  - Only numerals matched in granularity are freely able to 'compete'
  - Use of 'more than *n*' implicates 'not more than *m*' only for *m* matched to *n* in granularity level

Explaining “more than” implicature failure

- “more than 100” !+> “not more than 101”
  - Is there any reason, other than truth, for a speaker to choose the weaker statement rather than the stronger?
  - **YES**
  - 101 is of a finer granularity than 100
    - Disfavoured communicatively
- Hearer:
  - Speaker chose to say “more than 100”…
  - …but maybe that was just in order to use a coarse-grained value…
  - …so the implicature is not available

Predicting “more than” implicature success

- Speaker says “more than 100”
  - What if “more than 1000” was the case?
  - Numeral of equally coarse granularity (or more so)
  - Harmonically bounds weaker term (OT parlance)
- Hearer should be able to conclude that
  - “more than 1000” isn’t the case
  - “more than 200” probably isn’t
  - “more than 150/125/110” might not be…
- Does the hearer exploit this?

Experiment 1:
Implicatures from modified numerals

Information: A newspaper reported the following.

"[Numerical expression] people attended the public meeting about the new highway construction project."

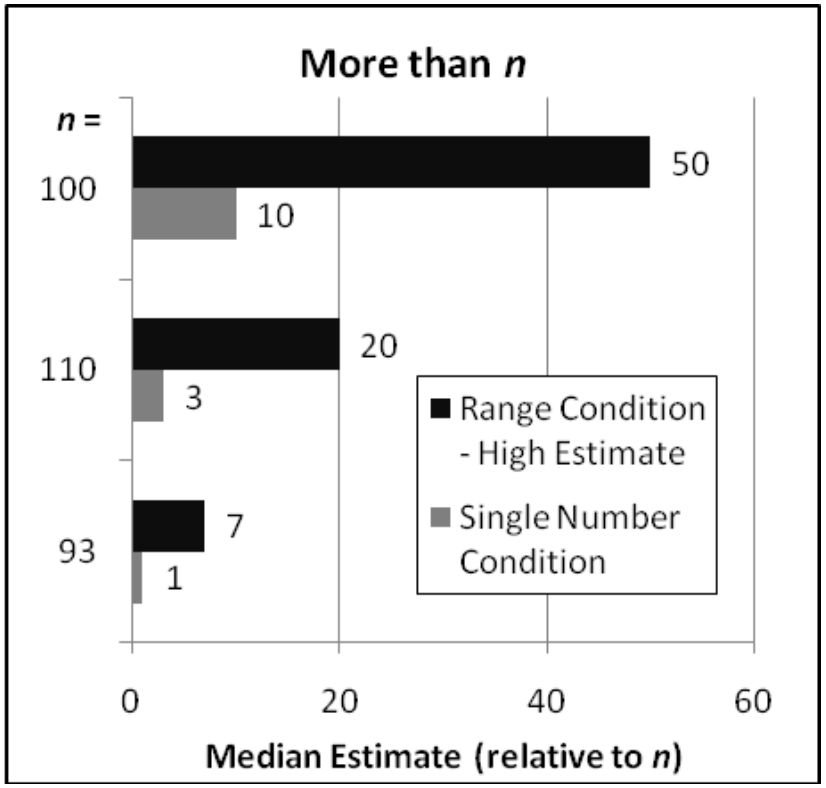
Question: Based on reading this, how many people do you think attended the meeting?

Between _____ and _____ people attended [range condition]

_____ people attended [single number condition].

Cummins, Sauerland and Solt (submitted)

Results



Fielded on Mechanical Turk: 6 conditions (2 prompts x 3 granularity levels)

100 participants per condition

ANOVAs show significant effects of granularity to both range and single number prompts ($p < 0.05$)

Comments reflect explicit awareness of this reasoning

Effect of numeral activation on implicature

- Less obvious prediction:
  - **Prior mention of numeral attenuates implicature**

A: We need to sell (*n*) tickets to break even.
B: We've already sold more than *n* tickets.

- No prior mention
  - Hearer reasons as before – implicature conditioned by salience
- Prior mention
  - Speaker could have said 'more than *m*' for some *m* > *n*…
  - …but maybe chose 'more than *n*' to reuse activated number…
  - …so implicature not available.

Experiment 2:
Attenuation of implicatures…

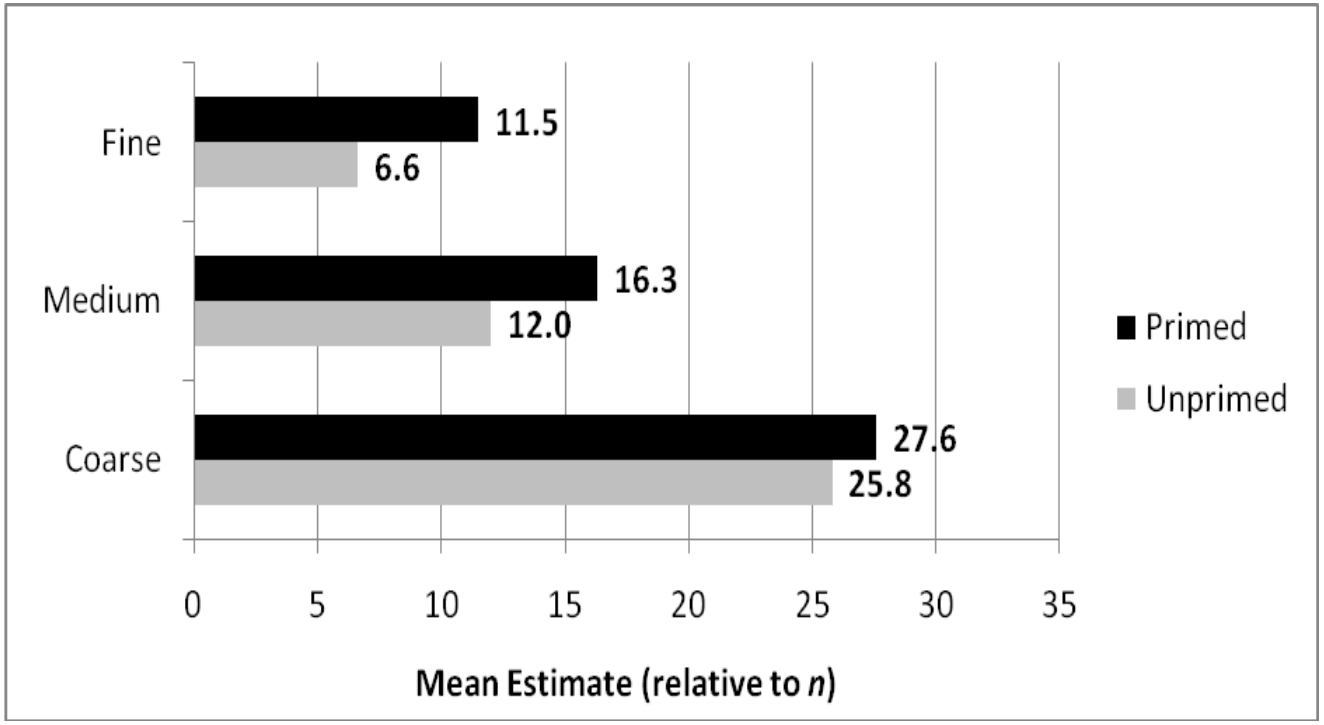
Please read the following short dialogues, and answer the questions by filling in a value for each blank space, according to your opinion. Consider each dialogue separately. Assume that participant B is well-informed, telling the truth, and being co-operative in each case.

A: We need to sell (60) tickets to cover our costs. How are the ticket sales going?

B: So far, we've sold more than 60 tickets.

How many tickets have been sold? From …… to ……, most likely …….

Results



40 participants: “more than” and “fewer than” conditions.

3x2x2 ANOVA shows main effects of

quantifier ($F(1,41)= 8.66$, $p<0.01$)

roundness ($F(2,80)=44.83$, $p<0.001$)

priming ($F(1,40)=10.78$, $p<0.01$).

Constraints on speakers' choices of utterance?

- Experimental findings that comparative quantifiers yield scalar implicatures
  - conditioned by granularity
  - conditioned by prior mention of numeral

- Meanwhile, findings that SIs not available when
  - Stronger statement would be irrelevant (Breheny, Katsos and Williams 2006)
  - Stronger statement is understood to be beyond speaker's knowledge (Breheny, Ferguson and Katsos submitted)
  - Stronger statement would be face-threatening (Bonnefon, Feeney and Villejoubert 2009)

Constraints on speakers' choices of utterance?

- General observation:
  Where the speaker has no choice, the hearer cannot draw an inference
  - Corollary of Gricean pragmatics

- Speaker's choice appears to be constrained by
  - Granularity
  - Numeral priming
  - Informativeness
  - Quantifier simplicity (Cummins and Katsos 2010)
  - Truthfulness etc.

Sketch of constraint-based model

- Speaker:
  - Selects optimal utterance given need to convey information while satisfying (potentially irreconcilable) constraints
- Hearer:
  - Attempts to calculate speaker's intention given the presumed fact that the utterance was optimal
  - Aims to factor in knowledge about speaker's communicative preferences to establish what pragmatic enrichments are valid

- Could model this in OT
  - Unidirectional speaker-referring model (Cummins submitted)

Conclusion

- Scalar implicatures available from expressions such as "more than *n*"
  - Contrary to existing claims…
  - …but coherent with the classical approach to implicature
- These SIs conditioned by
  - Granularity
  - Numeral salience/activation
- Inferences of this type predicted by constraint-based model
  - Model aims to characterise speaker behaviour…
  - …and circumscribes pragmatic enrichments available to hearer

Thank you!

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