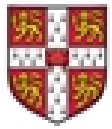

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Recovering some, if not all, of the speaker's meaning

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Implicatures and numerical expressions

- (Scalar) Implicatures
  - What they are
  - When they succeed and when they fail
- Numerically-quantified expressions
  - Failure of implicatures – a distinct phenomenon?
  - A constraint-based model for their usage (and interpretation)
  - Verifying the predicted pragmatic enrichments
- SIs in a constraint-based model
  - Probabilistic implicatures?
  - Probabilistic representations of propositional content?

Implicatures

- Classical (Gricean) view:
  - Pragmatic enrichments
  - Arising from what the speaker chose **not** to say

A. Is Tom a good lecturer?
B. He has a nice line in sweaters.

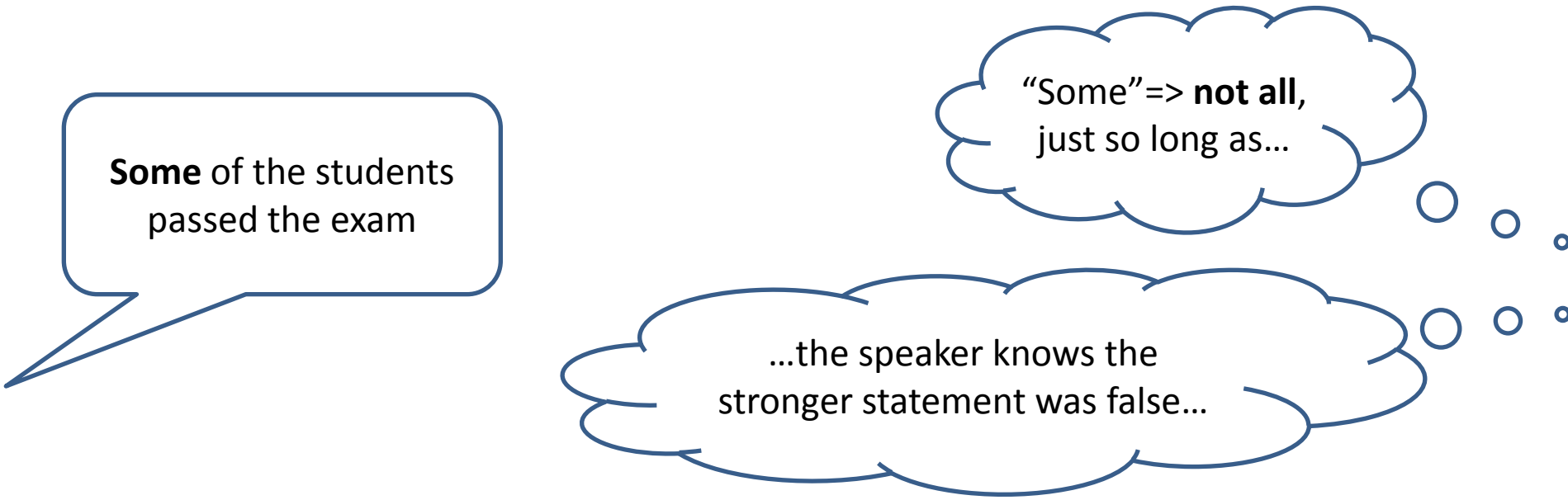
=> Tom is not a good lecturer (in B's opinion)

- Sub-case: **scalar** implicatures

A. Did your students pass the exam?
B. <u>Some</u> of them did.

=> <u>Not all</u> of B's students passed the exam

Criteria for scalar implicature calculation



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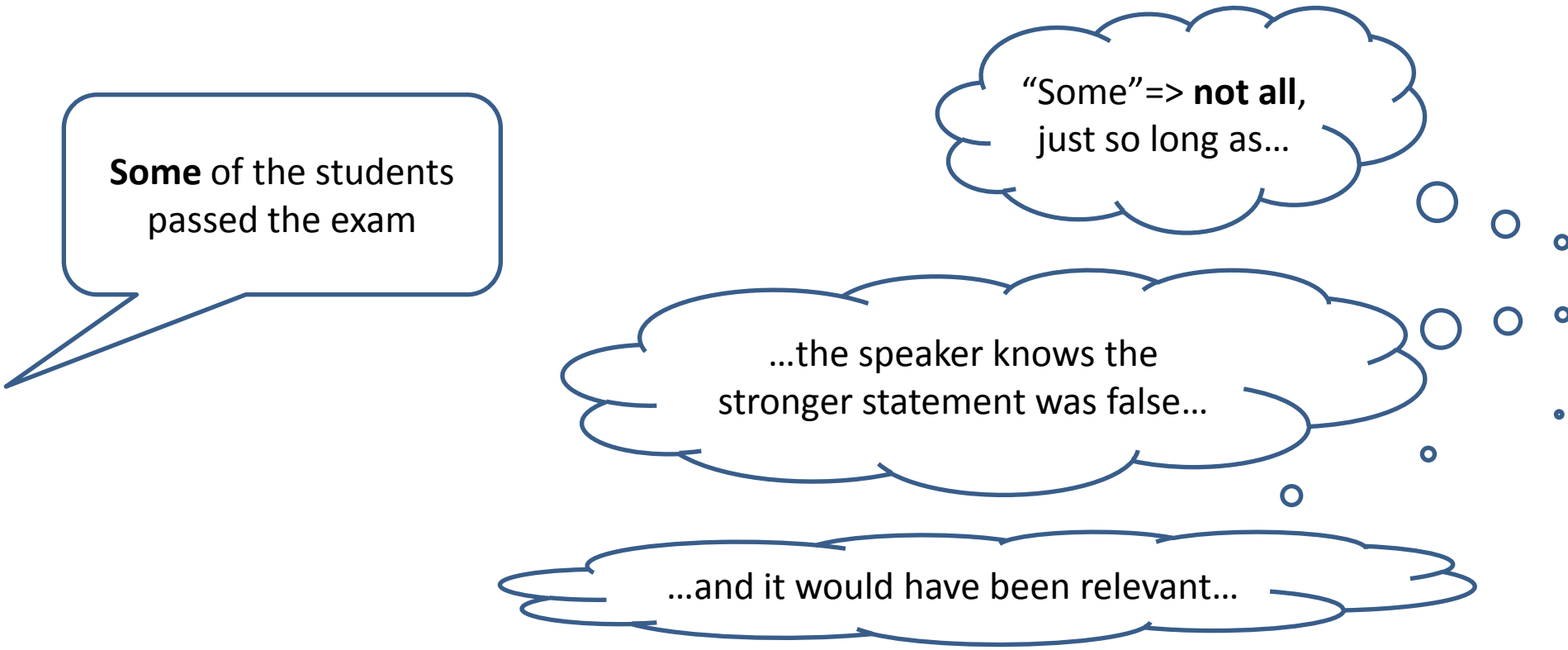


Relevance of stronger proposition

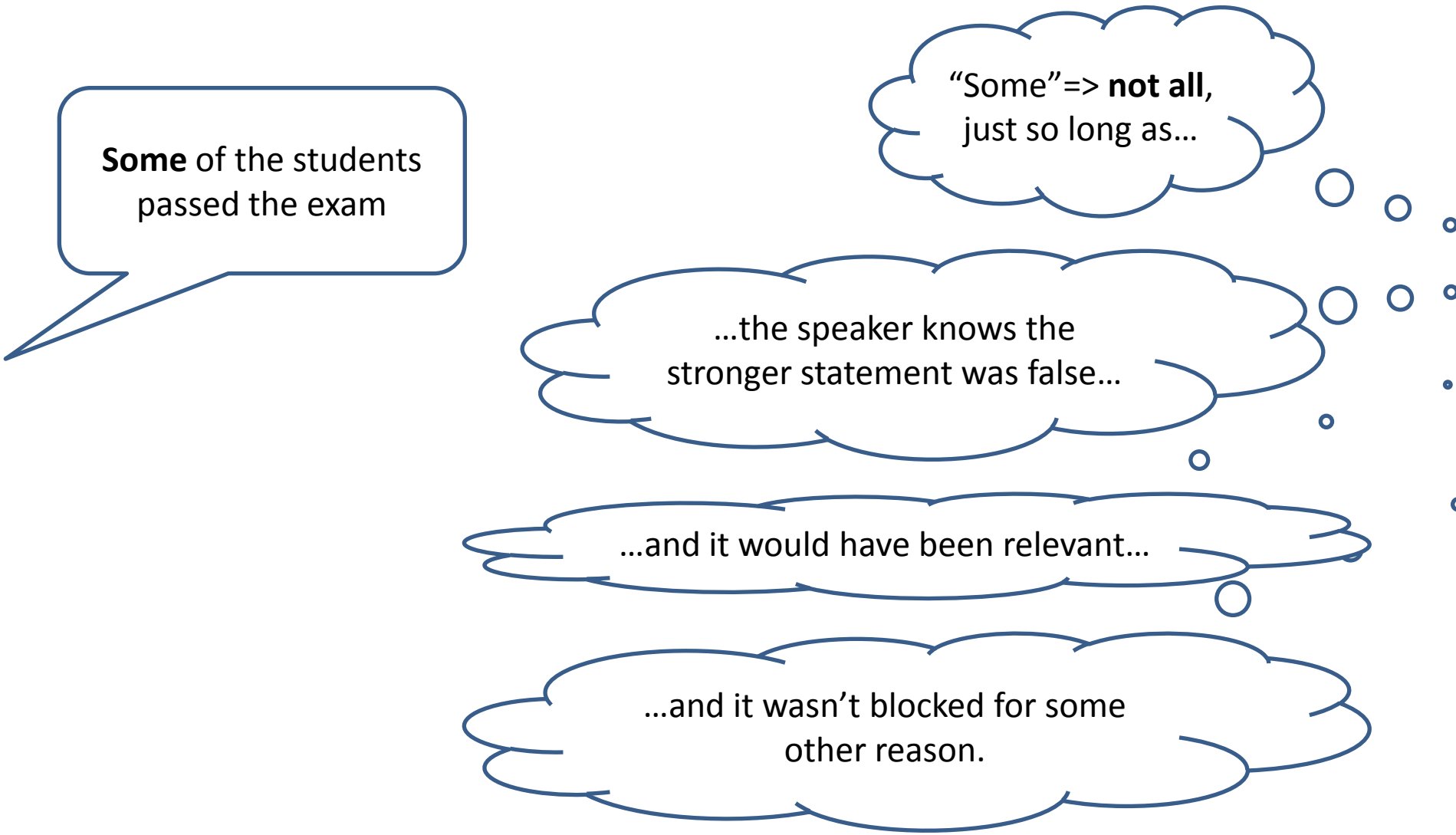
- Weaker statement is satisfactory: no implicature

  A: What do you have to do to get a scholarship?
  B: You have to get distinction grades in some exams.

  A: Who is available to interview applicants?
  B: Anna or Bert from Human Resources.

- Accords with Relevance Theory (Sperber and Wilson 1986/1995)

Criteria for scalar implicature calculation



Unavailability of stronger statement

- Stronger statement may be blocked
  - e.g. on grounds of politeness: Bonnefon, Feeney and Villejoubert (2009)

A: What kind of impression did I make at dinner?

B: Some of the guests thought that you drank too much.

  - Stronger statement would be face-threatening
  - B may suppose A is just being polite, even if 'all' would be true.
  - Hence hearer fails to draw the 'reassuring' implicature.

Interim summary

- Hearers recover scalar implicatures
  - Only when the speaker could have made a more informative statement, knowledgeably, relevantly and politely
  - (and apparently only once having established that these conditions hold)

- No option for the speaker => no implicature for the hearer

Numerals and implicature

- Unmodified numerals are ambiguous between cardinal and existential readings
  - Claimed that precise 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

Implicature failure in the numerical domain

- "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?
- What's the enrichment?

Modelling the speaker's decision procedure

- Why is "more than 100 people study at this university" pragmatically anomalous?
  - Underinformative (to an unreasonable extent)
  - Better options available

- Idea: treat this as a problem of multiple constraint satisfaction
  - 'Be informative' is one constraint
  - What else?

Building a constraint-based model

- Many semantically truthful options are available for the speaker's use in a given situation

More than 20/19/18…

Fewer than 25/26/27… …boats are in the harbour

Between 20 and 25/19 and 26…

Building a constraint-based model

- Some of these are evidently unsatisfactory because they violate criteria for efficiency

?*23, or – slightly less likely – 24, or…*

?*More than two…* …boats are in the harbour

?*Less than a million…*

Building a constraint-based model

- These criteria cannot typically all be satisfied at once

*(Exactly) 23…

*(About) 20… …boats are in the harbour

*Some…

Constraint-based model of speaker's choice

- Two main components:
  - (Individually) ranked list of relevant constraints
  - Selection procedure to determine optimal utterance

- Classical Optimality Theory account
  - Speaker-referring
  - Unidirectional

(Constraints on) constraints

- Constraints in such an account must be
  - Preferred
  - Non-obligatory
  - Defined in such a way that their violations can be calculated

- Proposed constraints are
  - Informativeness
  - Quantifier simplicity
  - Numeral salience
  - Granularity
  - Numeral / quantifier priming

Numeral-referring constraints

- Potentially interdisciplinary model
  - Musolino (2004), among others, emphasises importance of considering aspects of numerical cognition when discussing numerically-quantified expressions
- Number-specific constraints present here
  - Numeral salience
    - (actually derived from psychology-of-number considerations)
  - Numeral priming

- Can apply these (plus informativeness constraint) to the analysis of "more than *n*", etc.

Explaining “more than” implicature failure

- “more than 100” !=> “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 a less salient number than 100
    - Disfavoured communicatively
    - Violates numeral salience constraint
- Hearer:
  - Speaker chose to say “more than 100”…
  - …but maybe that was just to satisfy numeral salience…
  - …so the implicature is not available

But recovering part of the implicature

- Speaker says “more than 100”
  - What if “more than 1000” was the case?
  - Numeral just as salient
  - 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…
- Seems to match our intuitions tolerably well

Experimental verification

Information: A newspaper reported the following.

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

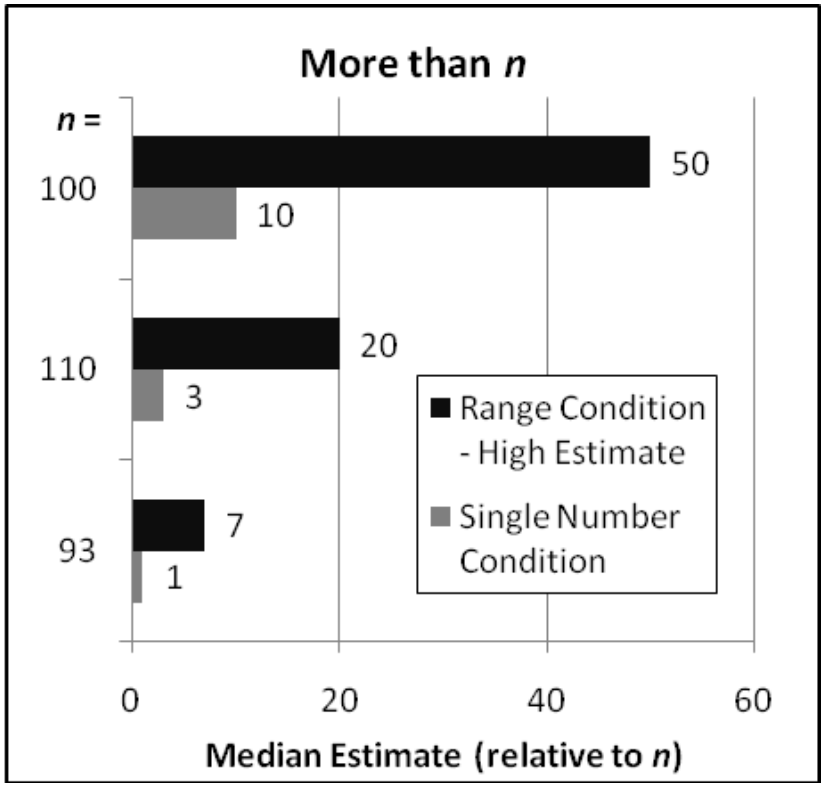
Question: Based on reading this, how many people do you think attended the meeting?

Between _____ and _____ people attended [range condition]

_____ people attended [single number condition].

Cummins, Sauerland and Solt (submitted)

Experimental verification



Fielded on MTurk: 100 participants per condition

ANOVAs show significant effects in both conditions ($p < 0.05$)

Comments reflect explicit awareness of this reasoning

Effect of priming on this 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 satisfy numeral priming…
  - …so implicature not available.

Experimental verification (2)

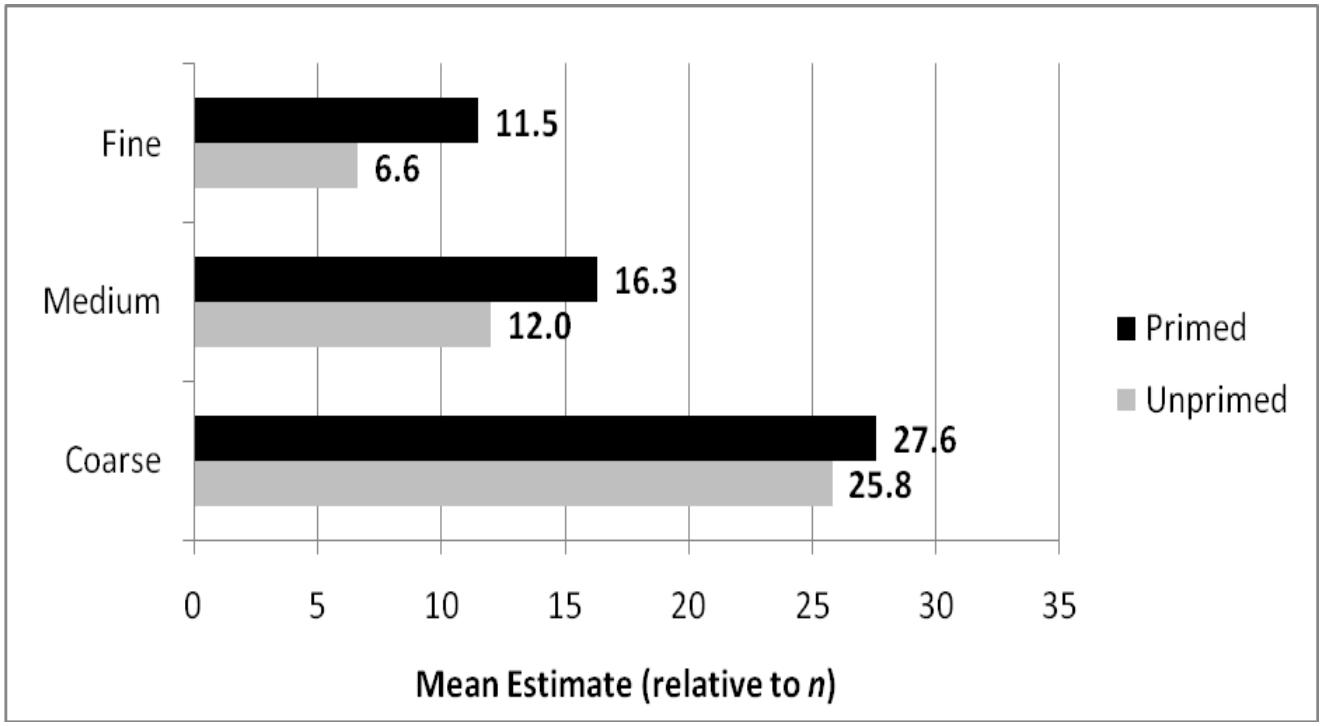
Please read the following short dialogues, and answer the questions by filling in a value for each blank space, according to your opinion. Consider each dialogue separately. Assume that participant B is well-informed, telling the truth, and being co-operative in each case.

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

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

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

Experimental verification (2)



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

Numeral priming in a constraint model?

- Does this constitute unambiguous evidence for numeral priming in particular / the constraint-based model in general?
  - NO
    - Could reflect the operation of some other constraint, e.g. relating to Question Under Discussion
    - Could be modelled by some other technique, e.g. using a connectionist model
- However, does succeed in predicting and explaining these previously unknown / rejected implicatures

Constraints and classical pragmatics

- Classical view:
  - Implicature succeeds except when alternative is blocked because
    - Not known to speaker
    - Not polite
    - Not relevant to discourse needs, etc.
- Constraint-based view:
  - Implicature succeeds except when alternative is blocked because
    - It violates numeral salience
    - It violates numeral priming
    - It violates quantifier simplicity, etc.
- Both views: no choice ⇔ no implicature

Hearer's viewpoint

- To obtain implicature, hearer must determine whether
  - stronger statements were rejected because the speaker knows them to be false (licensing implicature), or
  - stronger statements are rejected by the speaker for some other reasons (licensing no implicature)

- Speaker says "more than 100"
  - How does the hearer know that 100 isn't somehow 'primed'?
  - cf. speaker's knowledge: 'some' – do they know about 'all'?

- Goal of hearer: compute implicature exactly when it holds

Towards probabilistic implicatures?

- Hearer must either
  - Draw implicatures and risk over-interpreting utterances
  - Fail to draw implicatures and risk under-interpreting utterances

- Given uncertainty, case for probabilistic implicature: either
  - A decision is taken on probabilistic grounds to draw the implicature
  - Drawing the implicature means raising perceived probability of the truth of corresponding proposition

Constraints and probabilistic implicature

- Speakers have individual constraint rankings
  - Utterance reflects intention and constraint ranking
- Utterances may either
  - Be preferred for many situations under many rankings (‘some’)
  - Be preferred for few situations under many rankings (‘more than 55’)
  - Be preferred for different (sets of) situations under different rankings (‘more than 100’)
- Interpretation: probability of situation conditioned by probability of constraint ranking

General implications of this viewpoint

- Hearers are assumed to be able to manage complex representations – a 'landscape of probability'
  - Suggests that probability might be bound up in the nature of representations of propositional content
- Speakers can presumably do likewise
  - which suggests that the speaker's intention could also be a complex construct of a similar type
  - which in turn has interesting implications with respect to e.g.
    - evaluating the informativeness of a candidate utterance, as part of determining the optimal expression
    - reasoning with quantity representations
    - **the representation of other forms of asserted and non-asserted content**

Presuppositions?

- Problem of presupposition accommodation
  - "The King of France is *not* bald"
  - "I *didn't* realise that sharks were mammals"
- Possible idea
  - Speaker's choice of utterance is optimised with respect to several constraints
  - Optimal utterance may nevertheless convey infelicitous presuppositions
  - Hearer accounts for this, just as for the infelicitous SI, by reasoning that presupposition trigger is contextually forced rather than corresponding to the speaker's intention

Conclusion

- Can model choice of numerically-quantified expression using constraint-based approach
  - Yields predictions about pragmatic enrichment of such expressions that are
    - intuitively plausible
    - borne out experimentally
    - contradictory to existing literature
  - Approach fits with general Gricean pragmatic principles
    - Implicatures only where speaker chooses to use weaker utterance, taking other determinants of this into account
  - Possibility of generalising approach to other domains
    - Accounting for SIs in other areas
    - Accounting for other forms of non-asserted content?

References

- Bonnefon, J.-F., Feeney, A. and Villejoubert, G. (2009). When some is actually all: Scalar implicatures in face-threatening contexts. *Cognition*, 112: 249-58.
- Cummins, C., Sauerland, S. and Solt, S. (submitted). Granularity and scalar implicature in numerical expressions.
- Fox, D. and Hackl, M. (2006). The universal density of measurement. *Linguistics and Philosophy*, 29: 537-86.
- Geurts, B., Katsos, N., Cummins, C., Moons, J. and Noordman, L. (2010). Scalar quantifiers: logic, acquisition, and processing. *Language and Cognitive Processes*, 25(1): 130-48.
- Krifka, M. (1999). At least some determiners aren't determiners. In K. Turner (ed.), *The Semantics/Pragmatics Interface from Different Points of View*, Current Research in the Semantics/Pragmatics Interface Vol. 1. Oxford: Elsevier. 257-92.
- Musolino, J. (2004). The semantics and acquisition of number words: integrating linguistic and developmental perspectives. *Cognition*, 93: 1-41.
- Sperber, D. and Wilson, D. (1986/1995). *Relevance: Communication and cognition*. Oxford: Blackwell.