

# Experimental results on embedded implicatures

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## Overview

This handout reviews recent experimental results concerning the prevalence of embedded scalar implicatures. The focus is on Geurts and Pouscoulous 2009 (henceforth GP09), which argues that these implicatures are marginal at best, and Chemla and Spector 2011 (CS11), which argues that they are robust. I also include brief summaries of the three commentaries on GP09 that appeared in 2010 in *Semantics and Pragmatics*, to provide some context on how the field is reacting.

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## 1 Geurts and Pouscoulous (2009)

The general thrust of Geurts and Pouscoulous 2009 (henceforth GP09): localist theories predict that local implicatures are preferred. The experimental results in this paper suggest that they are marginal at best.

- Mainstream conventionalism: “SIs aren’t so much inferences as special information packets which are associated with scalar expressions by linguistic convention” (p. 3).
- Minimal conventionalism: “stick to your favorite lexicalist or syntax-based brand of SIs, which will duly generate a batch of interpretations for any sentence containing scalar expressions, but refuse to make predictions about which construal is the preferred one. Leave it to pragmatics.” (p. 24)

### 1.1 Experiments 1a and 1b

Participants were presented with sentences containing *some of the NP* and asked whether they would also infer that the embedded implicature is true. They chose from “yes” or “no”.

Environment for <i>some of the NP</i>	Exp. 1	Exp. 2
Unembedded	0.93	0.94
Scope of a universal	0.27	–
Scope of an epistemic modal	0.03	–
Scope of <i>think</i>	0.50	0.65
Scope of <i>want</i>	–	0.32

Table 1: Percentage of “yes” responses.

**Their conclusions:**

- The data are consistent with scalar implicatures being default inferences in unembedded cases.
- The embedded implicatures meanings predicted to be prominent by localism are hard for people to perceive and thus unstable

GP09 reject arguments that the local readings are far-fetched (p. 10-13), and they also argue that the increased complexity of the sentences is not enough to explain the drop in scalar inferences.

### 1.2 Experiment 2

GP09 worry that experiments 1a and 1b exaggerate the rate of scalar inferences because they make the scalar inference highly relevant (p. 14-15). Experiment 2 sought to test this.

Condition	Percentage “Yes”									
<i>Inference</i> : Decide whether the sentence implies that not all of the B’s are in the box on the left	0.62									
<i>Verification</i> : decide whether the sentence accurately describes the following picture: <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>B</td><td>B</td><td>B</td><td>A</td><td>A</td><td>A</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>C</td><td>C</td><td>C</td></tr></table>	B	B	B	A	A	A	C	C	C	0.34
B	B	B	A	A	A					
C	C	C								

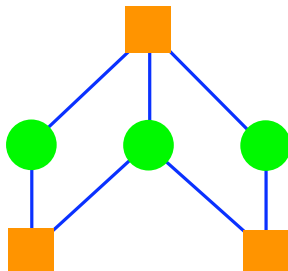
Table 2: Responses for *Some of the B’s are in the box on the left*. (Translated from French.)

**Their conclusions:**

- Inference tasks encourage implicatures,
- Verification tasks discourage implicatures. (See sec. 2.3 below for a direct rejoinder from Clifton and Dube 2010.)

### 1.3 Experiment 3

Experiment 3 compare the inference and verification paradigms, and it tests the rate at which people draw local implicatures in upward monotone and in non-downward monotone contexts.



All the squares are connected with some of the circles.

true     false

Figure 2: Verification item used in Experiment 3.

Betty says:

*All the squares are connected with some of the circles.*

Could you infer from this that, according to Betty:

All the squares are connected with some but not all of the circles.

yes     no

Figure 3: Inference item used in Experiment 3.

Figure 1: Sample items from experiment 3.

- In the verification condition, the images always distinguished the global implicature reading and the local implicature reading.
- Because the local implicature entails the global implicature, participants never got to judge a local reading true.
- For the *exactly two* trials, there were two images, testing different localist hypotheses.

Example (translated from Dutch)	Verification		Inference	
	% true	Localist predict.	% yes	Localist predict.
All the squares are connected with some of the circles.	1	(0)	0.46	(1)
There is more than one square that is connected with some of the circles.	1	(0)	0.62	(1)
There are exactly two squares that are connected with some of the circles.	1	(0)	0.5	(1)
There are exactly two squares that are connected with some of the circles.	0	(1)		
Not all the squares are connected with some of the circles.	0.04	(0)	0.58	(0)
There isn't more than one square that is connected with some of circles.	0.04	(0)	0.46	(0)

Table 3: Experiment 3 results. Overall, it looks like participants could not do the inference task; the responses are all around chance. The verification responses are consistent with the Gricean position, but the localist could respond that they just show that the non-local reading is available CS11, §2.2.

## 1.4 Experiment 4

- This experiment probes ‘minimal conventionalism’, the position that the grammar generates a wide range of local and global meanings and pragmatic theory finally makes predictions about which ones people use.<sup>1</sup>
- The experiment uses English translations of the materials from experiment 3’s verification conditions, but now subjects chose from “yes”, “no”, and “could be either”.
- The hypothesis: if the sentences are semantically ambiguous between local and global readings, subjects will recognize this and chose the third option.
- The experiment includes a number of controls involving standard ambiguities to check whether subjects actually do this.

Example	yes	no	could be either
All the squares are connected with some of the circles.	0.95	0.05	0.00
There is more than one square that is connected with some of the circles.	1.00	0.00	0.00
There are exactly two squares that are connected with some of the circles.	0.86	0.05	0.09
There are exactly two squares that are connected with some of the circles.	0.09	0.77	0.14
Not all the squares are connected with some of the circles.	0.09	0.86	0.05
There isn’t more than one square that is connected with some of circles.	0.09	0.91	0.00

Table 4: Experiment 4 results. GP09 conclude that the response rates for the shaded boxes are so high as to be inconsistent with minimal conventionalism.

Example	could be either
The circles and the squares are connected with each other.	0.82
The green and the orange figures are connected with each other.	0.73
All the figures are orange and green.	0.59
There are green circles and squares.	0.77
The circles and the squares have the same colour.	0.59

Table 5: Experiment 4 results for the ambiguous controls.

<sup>1</sup>Despite GP09’s characterization, this seems to be the position of Chierchia et al. (To appear), who often invoke general pragmatic considerations to explain which readings are prominent. See also Sauerland 2010:4.

## 2 Immediate responses

Here are quick summaries of the three responses that appear in *Semantics and Pragmatics* as direct replies to GP09. All are worth of additional study; these summaries are meant to convey a flavor for how debate went.

### 2.1 Ippolito (2010)

Ippolito (2010) seeks to amplify GP09's arguments against localism by arguing that localism cannot account for the variable rates at which people detect implicatures embedded under attitude predicates — whatever preference theory the localist adopts runs afoul of this variable behavior.

### 2.2 Sauerland (2010)

Sauerland (2010) responds to both GP09 and Chemla (2009). His central conclusions:

- It is now clear that there are cases in which implicatures form part of the truth-conditional content (he cites conditionals and Hurford's constraint as providing strong support).
- GP09 and Chemla are to be commended for pushing forward our understanding of how prevalent this embedding is. However, two other questions are equally or more important: are embedding implicatures a uniform phenomenon, and are they truly implicatures at all?
- Both papers target only the radical localism of Levinson (2000) and Chierchia (2004), whereas the more relaxed version represented by Chierchia et al. (To appear) and related papers doesn't necessarily predict a preference for local readings.
- GP09 argument against minimal conventionalism is mistaken because people process ambiguities differently when there are entailment relations between the readings. In such cases, people detect only the weaker (more encompassing) meaning.

### 2.3 Clifton and Dube (2010)

- Clifton and Dube (2010) focus on GP09's verification task.
- GP09's pictures can be described in many ways. Subjects were not asked to register a view on whether the description given was the best, but rather only whether it fit. This creates a bias for weak readings.
- Thus, Clifton and Dube (2010) ran two experiments in which subjects were given two displays, one consistent with the strong localist account, the other in violation of it, and asked to choose the display that best matched the sentence.
- In both experiments, they found that subjects picked the display that was consistent with the strengthened version — a standard implicature in the case of their experiment 1, and a local enrichment in the case of experiment 2.
- Thus, GP09 design undercounted enrichments; altering the paradigm makes them significantly more prevalent, which is consistent with the localist position.

### 3 Chemla and Spector (2011)

CS11 adapt G&S’s verification methodology, seeking to show that, when the images are clearer and the experimental task makes implicatures relevant, speakers favor readings only generated by localists. The paper reports on two experiments. CS11 argue that the neo-Gricean can successfully explain the results of experiment 1 using techniques developed by Sauerland (2001) and Fox (2007), but that she cannot explain the results of experiment 2.

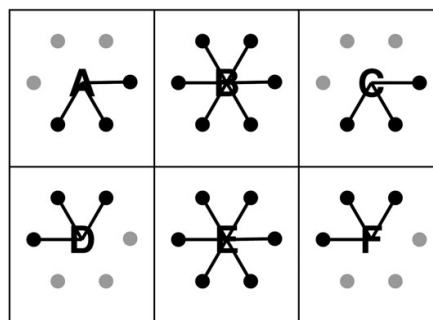
#### 3.1 Methodological criticisms of GP09

- GP09 failed to detect localist readings, but it doesn’t follow that they are unattested (p. 364).
- GP09’s pictures were hard to decipher (p. 365).
- GP09 failed to make the local reading pragmatically relevant (p. 365). This is broadly similar to the objection of Clifton and Dube (2010).
- Because the local reading unilaterally entails the global reading, it might be hard to detect, especially when unmotivated (p. 365-366). This is broadly similar to the objection of Sauerland (2010).

#### 3.2 Design, materials, and methods

- The experiments test both *some of the NP* and *or*.
- CS11 maintain that the images are easier to parse in the relevant ways.
- CS11 maintain that their images also draw attention to the distinctions needed to bring out the local reading (GP09 would likely be sympathetic; see their worry #3, p. 15).
- Subjects made graded judgments from ‘No’ to ‘Yes’. CS11 hoped that this would encourage them to distinguish the various readings despite their entailment relations.
- Because of the entailment relationships among the readings at issue, CS11 invoke an extra hypothesis: the more readings that are true, the more people will tend towards ‘Yes’.

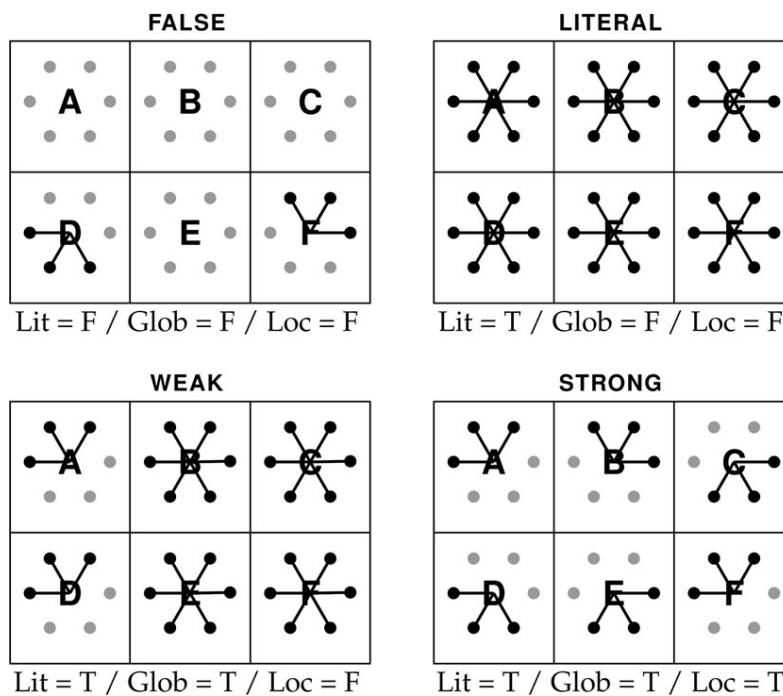
Every letter is connected with some of its circles.



**Figure 2** Example where the global reading is true, while the local reading is false. This item is a counterpart of Geurts and Pouscoulous’ item represented in Figure 1. Note: The connected dots and the connecting segments were coloured (red in this particular case), and the non-connected dots appeared in grey.

### 3.3 Experiment 1: Scalar items in universal sentences

- (1) Every letter is connected with some of its circles.
  - a. *Literal reading*: each letter is connected with at least one (maybe all) of its circles
  - b. *Global reading*: each letter is connected with at least one of its circles, and it is not the case that each letter is connected with all its circles
  - c. *Local reading*: each letter is connected with at least one of its circles, and no letter is connected with all its circles
- (2) Entailment relations between conditions: Local  $\rightarrow$  Global  $\rightarrow$  Literal



**Figure 4** Illustrative examples of the images used to illustrate the different conditions **FALSE**, **LITERAL**, **WEAK** and **STRONG** for the test sentence (8): ‘Every letter is connected with some of its circles’. We also reported below each image whether the literal (Lit), global (Glob) and local (Loc) readings are true (T) or false (F).

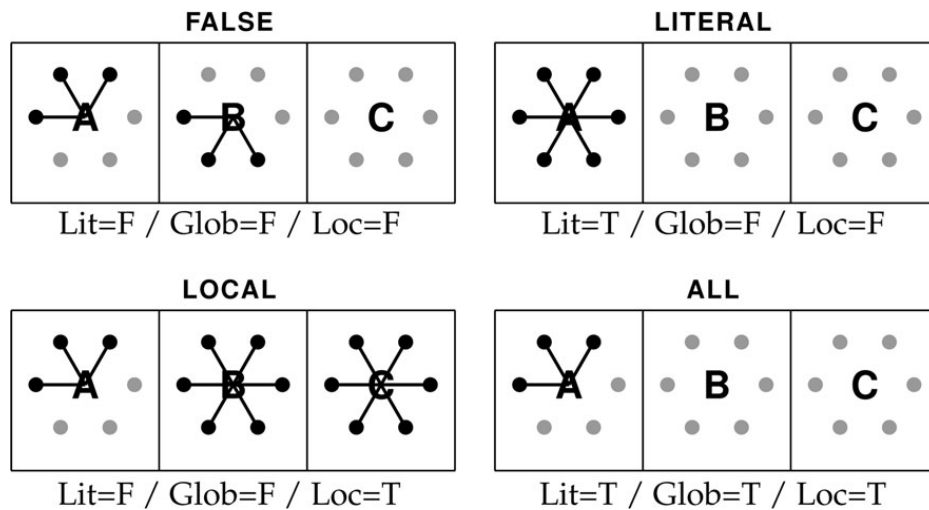


**Figure 5** Main results: mean position of the cursor in the target conditions of experiment 1 (see section 4.2.1 or Figure 4 for an illustration). Error bars represent standard errors to the mean.

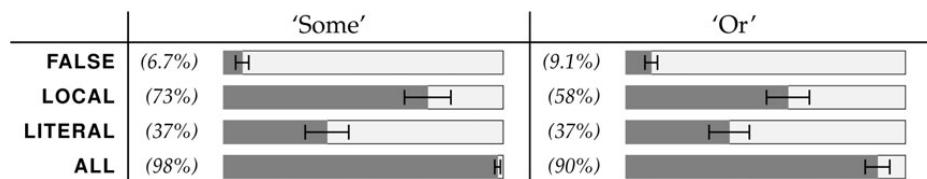
### 3.4 Experiment 2: Scalar items in non-monotonic sentences

- (3) Exactly one letter is connected with some of its circles.
- a. *Literal meaning*: one letter is connected with some or all of its circles, the other letters are connected with no circle.
  - b. *Global reading*: one letter is connected with some but not all of its circles, the other letters are connected with no circle.
  - c. *Local reading*: one letter is connected with some but not all of its circles, the other letters may be connected with either none or all of their circles.

- (4) Entailment relations between conditions: Global  $\begin{cases} \nearrow \text{Local} \\ \searrow \text{Literal} \end{cases}$



**Figure 11** Illustrative examples of the images used to illustrate the different conditions **FALSE**, **LITERAL**, **LOCAL** and **ALL** for the test sentence (21): 'Exactly one letter is connected with some of its circles'. We also reported below each image whether the literal (Lit), global (Glob) and local (Loc) readings are true (T) or false (F).



**Figure 12** Mean responses in the target conditions of experiment 2 (see section 5.3.1 or Figure 11 for an illustration).



### 3.5 Additional notes and loose ends

- CS11 test for ordering effects in both experiments, and they find none, though they caution that this is still something to be vigilant about (sec. 4.4.3, sec. 5.5.3).
- Both experiments closed with examples involving *no letter*. Localist theories predict that there will be no implicatures for such cases. The results suggest, though, that it is marginally available for *some* (sec. 4.4.4). The rate was higher for experiment 2, for unclear reasons (sec. 5.5.4).
- For experiment 1, where distributivity inferences like those in (16) were supported, the items were judged even better (sec. 4.4.5 and appendix 2.1).
- For experiment 1, the number of letters that contribute to the inference matters — the more, the better (sec. 4.4.6).

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