The interface between sentence meaning and speaker meaning

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Code Model:

I am wearing a suit
Code Model:

I am wearing a suit
Inferential Models
Two foundational ideas of Gricean pragmatics:

1) There is a distinction to be made between sentence meaning and speaker meaning.

2) There is some sort of standard in conversation.
There appear to be divergences in meaning between, on the one hand, at least some of what I call the FORMAL devices – $\neg$, $\land$, $\lor$, $\exists (x)$, $\exists (x)$, $f x$ (when these are given a standard two-valued interpretation) – and, on the other, what are taken to be their analogs or counterparts in natural language – such expressions as *not*, *and*, *or*, *if*, *all*, *some* (or at least one), *the*. Some logicians may at some time have wanted to claim that there are in fact no such divergences; but such claims, if made at all, have been somewhat rashly made, and those suspected of making them have been subjected to some pretty rough handling.
Many are familiar with Grice’s maxims

**Maxims of Quantity:**
1. Make your contribution as informative as is required
   (for the current purpose of the exchange)
2. Do not make your contribution more informative than is required

**Maxims of Quality:**
*Supermaxim*: Try to make your contribution one that is true.
1. Do not say what you believe to be false.
2. Do not say that for which you lack adequate evidence.

**Maxim of Relation:**
Be relevant.

**Maxims of Manner:**
*Supermaxim*: Be perspicuous
1. Avoid obscurity of expression.
2. Avoid ambiguity.
3. Be brief (avoid unnecessary prolixity).
4. Be orderly.
“Generalized conversational implicatures.”

X is meeting a woman tonight.  
_Implicature:_ Not his wife, sister, mother etc.

I broke a finger yesterday.  
_Implicature:_ It was my own finger that I broke.

**More typical examples:**

Bill is ill or he’s working at home.  
_Implicature:_ Bill isn’t both ill and working at home.

My son took off his trousers and got into bed.  
_Implicature:_ FIRST took trousers off and THEN got into bed.

The meal was decent.  
_Implicature:_ The meal was not excellent.
Two features of Grice’s explanation that are hard to square.

1. There is a convergence between the meaning of a logical term and what it “says”:

   “and” = &
   “or” = v

   However, implicatures are thought to be pieces of information that go beyond the semantics of logical terms. What they ultimately “mean” is what is “said” plus implicature.

2. Generalized Conversational Implicatures are thought to go through automatically (unlike Particularized implicatures) but to be cancelable (“defeasible”).
This shows promise:

Grice’s contribution helped propel the area of linguistic-pragmatics
Pragmatic enrichments

One exemplary sort of a pragmatic inference known as a “scalar” inference:

(1a) Some children have teddy bears
(1b) Inference: Not all children have teddy bears

(2a) The meal was decent
(2b) Inference: the meal wasn’t excellent

(3a) Either you work one hour less per week or you take an extra week of holidays.
(3b) Inference: You can’t have both one hour less work per week and an extra week of holidays.

Informativeness

![Diagram showing scalar inferences and their implications]

- Some
- Decent
- Excellent
- All
- And
- Or
Other enrichments:

e.g. related to conjunction

My son took off his trousers and got into bed.

-> My son FIRST took his trousers off and THEN got into bed.

a. Contrast:   It’s autumn in the U.S. and it’s spring in Chile.
b. Sequential: She took the scalpel and made the incision.
c. Containment: We spent the day in town and went to Macy’s.
d. Causal:     She shot him in the head and he died instantly.

- From Carston, 2000
What these examples have in common is a gain in informativity, where the pragmatic inference reduces the number of possible true cases.
Consider *Some X are Y*.

One can imagine 4 representations based on a minimal interpretation:

- $X \cup Y$
- $Y \cup X$
- $X \cap Y$
- $XY$

With *Some but not all X are Y*, only two representations remain:

- $X \cup Y$
- $X \cap Y$
- $Y \cup X$
- $XY$

One treats *Some* with the enrichment as a default, by way of a heuristic. However, this step could be cancelled by virtue of context.

By reducing the number of true instances, the enrichment renders the utterance more informative. Thus, there is a gain in effects. However, there is an extra step. Thus, there is a cost in effort.
Consider a categorization task where the quantifier is weaker than it ought to be:

For example,
Some cows are mammals (Certaines vaches sont des mammifères).
Some trout are fish (Certaines truites sont des poissons).
Some parakeets are birds (Certains perroquets sont des oiseaux).

_Biensur..._

All cows are mammals.
All trout are fish.
All parakeets are birds.

Thus, an interlocutor has a reason to be tempted to say that "Some cows are mammals" is _false_ because it implicates that _Not All cows are mammals._
Lewis Bott and I (Bott & Noveck, 2004, *JML*) have run 4 experiments based on the following paradigm:

54 items randomly presented by computer.

6 Categories -- mammals, fish, reptiles, shellfish, birds, fruit

1) Some cows are mammals. * (True logically/False with enrichment)
2) Some mammals are cows. (True)
3) Some cows are insects. (False)
4) All cows are mammals. (True)
5) All mammals are cows. (False)
6) All cows are insects. (False)
Experiment 3: Whole sentences, no specific instruction  
*E.g.* Some cows are mammals (*Certaines vaches sont des mammifères*)

Presented 54 items (6 categories; 9 per condition) and asked 32 participants to respond "True" or "False".

41% True and 59% False (in line with other data; Noveck, 2001)
T1) Some cows are mammals. (Logic - true / Pragmatic - false)
T2) Some mammals are cows. (True)
T3) Some cows are insects. (False)
T4) All cows are mammals. (True)
T5) All mammals are cows. (False)
T6) All cows are insects. (False)
This indicates that the "but not all" interpretation is effort consuming
Experiment 4: Controlling the amount of available effort.

The same task as before but with the following features

- One word at a time (to control uptake)

- Two lag times:  
  A) Short amount of time (900 msecs)
  B) Long amount (3 seconds).
Percentage saying "true" to each of the Sentence types in Experiment 4. N= 45.

<table>
<thead>
<tr>
<th>Utter.</th>
<th>Example</th>
<th>Short Lag (900 msecs)</th>
<th>Long lag (3000 msecs)</th>
<th>Logical response diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Some robins are birds</td>
<td>.72</td>
<td>.56</td>
<td>-.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p &lt; .001</td>
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<tr>
<td>T2</td>
<td>Some birds are robins (T)</td>
<td>.79</td>
<td>.79</td>
<td>.00</td>
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<tr>
<td>T3</td>
<td>Some robins are fish (F)</td>
<td>.12</td>
<td>.09</td>
<td>+.03</td>
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<td>T4</td>
<td>All robins are birds (T)</td>
<td>.75</td>
<td>.82</td>
<td>+.07</td>
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<tr>
<td>T5</td>
<td>All birds are robins (F)</td>
<td>.25</td>
<td>.16</td>
<td>+.09</td>
</tr>
<tr>
<td>T6</td>
<td>All robins are fish (F)</td>
<td>.19</td>
<td>.12</td>
<td>+.07</td>
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<tr>
<td>Experiment</td>
<td>% pragmatic</td>
<td>% logic</td>
<td></td>
<td></td>
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<tr>
<td>------------------------------------------------</td>
<td>-------------</td>
<td>---------</td>
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<td></td>
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<tr>
<td>Noveck (2001), Exp. 3</td>
<td>33%</td>
<td>40%</td>
<td></td>
<td></td>
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<tr>
<td>Bott &amp; Noveck (2004), Exp. 3</td>
<td>22%</td>
<td>6%</td>
<td></td>
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<td>Feeney et al. (2004), Exp. 3</td>
<td>6%</td>
<td>51%</td>
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<td>Guasti et al. (2005), Exp. 1</td>
<td>37%</td>
<td>37%</td>
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<tr>
<td>Guasti et al. (2005), Exp. 4</td>
<td>83%</td>
<td>17%</td>
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<td>Dieussart &amp; Schaeken</td>
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<td></td>
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<tr>
<td>Experiment 1 (low load)</td>
<td>52%</td>
<td>17%</td>
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<td>Experiment 1 (high load)</td>
<td>39%</td>
<td>18%</td>
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<tr>
<td>Experiment 2 (20 filler items)</td>
<td>54%</td>
<td>10%</td>
<td></td>
<td></td>
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<tr>
<td>Experiment 2 (50 filler items)</td>
<td>23%</td>
<td>14%</td>
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</tbody>
</table>

Noveck & Posada (2003) – ERP
Nieuwland, Ditman & Kuperberg (2010) – Proper sentences, ERP
Chevallier, Bonnefond, Van Der Henst & Noveck (2010) - ERP
De Neys & Schaeken (2006) – Dual Task
Breheny, Katsos, & Williams (2006) – Reading times in text
Huang & Snedeker (2009) – Eye-tracking
Conclusions of the Reaction Time experiments with *Some*.

1) No evidence that a pragmatic interpretation, viewed as "default" interpretation, is in any way faster, easier, prior.

2) Meanings compatible with the minimal interpretation of *Some* are faster (and produce higher rates of correct responses, also see Experiments 1 and 2 of paper).

3) Experiment 4 provides direct support to RT in that weaker interpretations are more likely to occur (i.e. deeper pragmatic processing is cut short) when the participant's resources are limited, i.e. less effort is made available.
Or: Initially inclusive or exclusive?

A pragmatic analysis indicates that exclusive interpretations are the result of adding “but not both” to the disjunction. If that is so, one would expect that inclusive interpretations of “or” to be primary.
We presented (96) 5-letter long Words, Pseudowords, and Non-words. After each, participants read a disjunctive or conjunctive sentence. 

*e.g.* Consider the word *TABLE* and the sentence *There is an A or a B*.

Three conditions: 
A) Participants see the word for 1 sec. before the sentence appears. 
B) The word stays up until response to test sentence. 
C) Participants are required to wait three seconds before answering.

Higher rates of exclusive interpretations when encouraged to take at least 3 seconds. No other condition was thus affected.
In a second experiment:
we investigated effort in a much more natural way -- prosody.

By putting an accent on “or” in a TT sentence, the speaker is placing greater stress on this word and prompts the listener to apply increased processing.

Compare: There is an A or a B.
There is an A OR a B.

This leads to the prediction that we would find higher rates of pragmatic enrichment for those sentences that include stress; i.e. more exclusive interpretations.

We presented a “take your time” version of the TABLE experiment with 4 conditions

• visually as before or else orally (sentences presented by a recording)
• accent on “or” in TT sentences or else similarly “flat” throughout
% logically accurate

Written - A or B
Written - A OR B
Oral - A or B
Oral - A OR B

(N=64)
There is an A or a B

Proportion responding “False”

$p < .001$
Time locked on “or”

Chevallier, Bonnefond, Van der Henst & Noveck, 2010
B. Pragmatic – Logical

FT7

LAN

Fz

Cz

P600

Amplitude (μV)

Time (ms)

+/- 2.88 μV  
t = 340 ms

+/- 4.05 μV  
t = 570 ms
Similar to Some, or is encoded minimally and could be good enough.

Deeper processing (whether through encouragement to spend more time on the sentences or through prosodic cues), allow interpretations become exclusive.
As Relevance Theory would anticipate:

Linguistically encoded meanings are underdetermined and compatible with weak (logical) readings.

All things being equal, pragmatic enrichments require some effort.

Thus, pragmatic enrichments arrive subsequent to logical readings.
(1) Relevance of an input to an individual

a. Other things being equal, the greater the positive cognitive effects achieved by processing an input, the greater the relevance of the input to the individual at that time.

b. Other things being equal, the greater the processing effort expended, the lower the relevance of the input to the individual at that time.

For example, compare:

(1) We are serving meat.

(2) We are serving chicken.

(3) Either we are serving chicken or \((72 - 3)\) is not 46.
Maxims of Quantity:
1. Make your contribution as informative as is required (for the current purpose of the exchange)
2. Do not make your contribution more informative than is required

Maxims of Quality:
Supermaxim: Try to make your contribution one that is true.
1. Do not say what you believe to be false.
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Maxim of Relation:
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Maxims of Manner:
Supermaxim: Be perspicuous
1. Avoid obscurity of expression.
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3. Be brief (avoid unnecessary prolixity).
4. Be orderly.

Another Gricean contribution:
There is some sort of standard in conversation.
End 1970’s/ 1980’s:

There was much experimental work on pragmatics in the wake of Grice’s William James lectures (1975):

A lot of it was developmental and its main goal was to determine when kids catch on to maxim violations:

- Ackerman, 1981; 1990
- Brédart, 1984; 1987
- Flavell et al., 1981
- Ironsmith & Whitehurst, 1978
- Whitehurst, 1976
Ironsmith and Whitehurst (1978)

“I am thinking of the person with antennae”

5 year olds choose randomly while rarely asking for clarification
8 year olds ask for clarification: roughly 27%
9-12 year olds ask reliably more often: roughly 55%
In talking about cases such as:

*Pick up the tall glass…*

Eye movement data show that the presence of contrasts (e.g., a short glass) in the context facilitates looks to target…
Edmundo Kronmüller & Tiffany Morisseau

Came up with a felicitous developmental task on a different class of pragmatic inferences – contrastive inferences
Imagine I show you (the participant) a set of four cards:

that I have as well
I take my set and turn the cards over…
I mix them up …
Now I take two:

I look at the two, show them to a friend and say:

“Show me the closed umbrella”
Question for the participant (who is watching this) is:

What is on the other card I’m holding?

Should be the other (open) umbrella

The adjective is additional information that can enrich sentence meaning and provide the speaker’s intended meaning.
Now, imagine that again I take two:

Now, imagine that again I take two:

I look at them, show them to a friend and say:

“Show me the umbrella”
Question for the participant (who is watching this) is:

What is on the other card?

Should be some other non-umbrella card

With no adjective, the best one can infer is that the two cards being talked about is the umbrella and something else (cat or fish).
Show me the brown rabbit.

In your opinion, what is the other card?
Materials didn’t matter
Pre- or Post-nominal position didn’t matter
Age mattered
Figure 2: Mean proportion of Contrast Object Selection Rate per condition and age group, Experiment 1. Error bars represent the standard error.
A number of things could be improved:

Number of cards 3: Why 2 distractors?

Ok...let’s put in just one distractor so that there is a Target, a Contrast, and a Distractor.

Everyone knows the content of all the cards: Could obviate the need for a contrast.

Make sure that participant handles all the cards and that she divides them herself into two sets.

Puts one set on a stand facing herself. Puts other set face down in front of Experimenter.

These improvements could facilitate performance so add younger children:

We add 7 year olds.
Now I take two:

I look at the two, show them to a friend and say:

“Show me the closed umbrella”
Figure 6: Mean proportion of Contrast Object Selection Rate per condition and age group, Experiment 3.
The 3 card case: How does enrichment provide a what is practically a reasoning solution on line?

Adjectival Modification:

One could either process it (the Target) without using it as a means to make further computations, in which case there are effects that are good enough (roughly equivalent to a literal interpretation).

This allows the addressee to identify 1 card out of 3 definitively. NOT BAD.

However, the adjectival modification is an imposition on processing; it ought to come with a payoff in cognitive effects:

A gain in modifying the noun is to highlight the contrasting card. This resolves the second card. Plus, this also allows one to classify the 3rd card, i.e., the one remaining face down. All 3 accounted for (100%; Excellent)!
Lack of Adjectival Modification:

The plain assertion identifies one of the contrast pairs as the Target. This puts the addressee in a position to identify 1 card out of 3, though with less precision than the case with a modifier. (It’s one of the two contrasted items) STILL, NOT BAD. This limits the array of possibilities to 4 combinations out of 6 (3!).

To simplify: Consider the 3 card case

\[
\begin{array}{ccc}
T/C & T/C & C/T \\
\end{array}
\]

However, further processing comes with cognitive effects. The gain is that it identifies one of the pair as held and removes both members of the pair from further consideration as possible second-cards… By elimination, this leaves the irrelevant card.
Take home message:

-- Language processing is not entirely free
-- it comes with processing risks
-- relies on the hearer’s/listener’s effort to exploit language in a way that can maximize effects
-- Inferential models of communication capture these features
Merci
Now I take two:

I look at the two, show them to a friend and say:

“Show me the closed umbrella”
Exp. 2

Figure 4: Mean proportion of Contrast Object Selection Rate per condition and age group, Experiment 2.
Cognitive Principle of Relevance
Human cognition tends to be geared to the maximisation of relevance.

Ostensive-inferential communication
a. The informative intention:
   The intention to inform an audience of something.

b. The communicative intention:
   The intention to inform the audience of one’s informative intention.

Communicative Principle of Relevance
Every ostensive stimulus conveys a presumption of its own optimal relevance.