The Semantics and Pragmatics of Numerals

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1 The Gricean Account

Under the Gricean account numerals have \textit{at least} semantics. This can be strengthened to an \textit{exactly} reading by a scalar implicature:

(1) Kyle to Ellen: “I have $9.”

\textit{Conversational implicature}: Kyle does not $>9$.

a. Contextual premise: Both Kyle and Ellen need $10$ for their movie tickets.

b. Contextual premise: It is mutual, public information that Kyle has complete knowledge of how much money he has on him.

c. Assume Kyle is cooperative at least insofar as he is obeying Quantity and Quality.

d. Then he will assert what is maximally relevant, informative, and true.

e. By (a), the proposition p that Kyle has $\$n$ for $9 < n \leq 10$ is more informative and relevant in this context than the proposition that he has $\$9$. f. Therefore, Kyle must lack sufficient evidence to assert p. g. By (b), he must lack evidence for p because it is false.

2 Evidence Against the Gricean Account

From Horn (2006):

(2) A: Do you have three kids?
B\textsubscript{1}: No, four.
B\textsubscript{2}: ? Yes, in fact four.

(3) A: Did many of the guests leave?
B\textsubscript{1}: # No, all of them did.
B\textsubscript{2}: Yes, in fact all of them did.

(4) a. # Neither of us liked the movie – she adored it and I hated it.

b. Neither of us has three kids – she has two and I have four.
A: Did most of the students pass the test?
B: No.

A: Did 6 of the students pass the test?
B: No.

a. I’ll bet you that the Dolphins will win most of their games this year.
b. I’ll bet you that the Dolphins will win some of their games this year.
c. I’ll bet you that the Dolphins will win 10 of their games this year.

From Breheny (2008):

a. Everyone who has two children receives tax benefits.
   (Implies everyone who has three or more children receives tax benefits.)
b. No one who has two children receives tax benefits.
   (May imply that everyone with three, four, etc. children receives benefits.)

No one who has three children is happy.

3 Other Accounts

- Underspecification approach - numerals are underspecified as to their meaning, and the correct interpretation is chosen based on pragmatic principles. The possible interpretations are at least, at most and exactly (Horn, 2006; Carston, 1988)

- Exactly semantics - the basic semantics of number words is an exactly reading (Breheny, 2008). At least and at most readings arise via contextual background knowledge. In cases where this is not sufficient he proposes a weakening mechanism which restricts those entities being quantified over to a subset that the speaker considers to have some property (e.g. There are three chairs in the conference room).

- Ambiguity approach - numerals are ambiguous between an at least and exactly approach. This can be done in one of two ways. Either the shift from one meaning to the other can occur via type-shifting, with the exactly reading as the starting point (Geurts, 2006) or using an exhaustivity operator to get from the at least semantics to exactly semantics (Spector, 2013).

(10) Exhaustivity Operator:

a. If $\phi$ is a sentence associated with a set of alternatives $C$ which contains $\phi$, then $\text{exh}(\phi)$ is the most informative true sentence in $C$.
b. a sentence $\phi$ counts as the most informative in a set if and only if it entails all the members of the set.
4 At most Readings

Are at least and at most different?

(11) a. One must be 18 years old to vote in the United States.
    b. #One must be 40 years old to be eligible for the Field’s medal. (Spector, 2013)

5 Predictions

The readings predicted to be available for numerals under scope of negation, modality and negated modality according to Geurts (2006) appear in Table 1.

<table>
<thead>
<tr>
<th>Environment</th>
<th>exactly</th>
<th>at least</th>
<th>at most</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>✓ semantics</td>
<td>✓ type shifting / pragmatics</td>
<td>✗ contradicts semantics?</td>
</tr>
<tr>
<td>not P</td>
<td>✓ semantics</td>
<td>✓ pragmatic inference</td>
<td>✓ negation of at least semantics / pragmatic inference</td>
</tr>
<tr>
<td>possible P</td>
<td>✓ semantics</td>
<td>✓ type shifting / pragmatics</td>
<td>✓ pragmatic enrichment of exactly semantics</td>
</tr>
<tr>
<td>necessary P</td>
<td>✓ semantics</td>
<td>✓ type shifting</td>
<td>✗ contradicts semantics?</td>
</tr>
<tr>
<td>possible not P</td>
<td>✓ semantics</td>
<td>✓ pragmatic inference</td>
<td>✓ negation of at least semantics</td>
</tr>
<tr>
<td>necessary not P</td>
<td>✓ semantics</td>
<td>✓ pragmatic inference</td>
<td>✓ negation of at least semantics</td>
</tr>
</tbody>
</table>

Table 1: Readings of Numerals in Different Environments - Geurts
6 Experiments

6.1 Experiment 1

Testing what readings people get in a neutral context:

1. Al said this circle contains three squares. Was he right?

2. Mike said this circle doesn’t contain three squares. Was he right?

3. Dave can pick a circle which contains three squares. This is the circle he picked. Did he follow the rules?

- Even in the can $P$ environment, where you might most expect to see an at most reading, there does not appear to be one. Is this because they don’t exist or is the context pushing away from them? Can they be encouraged to appear?
4. Jim must pick a circle which contains three squares. This is the circle he picked. Did he follow the rules?

[Graphs showing frequency distribution for MP-Condition A and MP-Condition C]

6.2 Experiment 2
Can the context be manipulated in such a way so as to make at most readings appear? Hot off the press:

1. In this game, one of the rules is that you have to play lower than the player before you, or draw a card. Al can play a circle which contains three squares. This is the card he played. Did he follow the rules?

[Graph showing frequency distribution for MP-Condition A and MP-Condition C]

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Bar</th>
<th>Response</th>
<th>%</th>
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<tbody>
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<td>Not at all -</td>
<td>[ ]</td>
<td>16</td>
<td>31%</td>
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<td>6</td>
<td>[ ]</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>7</td>
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<td>[ ]</td>
<td>25</td>
<td>48%</td>
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<td></td>
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<td>[ ]</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>[ ]</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

Statistic | Value |
-----------|-------|
Min Value  | 1     |
Max Value  | 7     |
Mean       | 4.46  |
Variance   | 7.51  |
Standard Deviation | 2.74 |
Total Responses | 52    |
References


