Integration of top-down and bottom-up information in online interpretations of scalar adjectives

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Real-Time Pragmatic Inferences

- Much work has studied pragmatic inferences affected by many sources of information. [e.g., Grice, 1975; Clark, 1996; Hagoort & van Berkum, 2004]

- But how do we so *rapidly* map the unfolding speech signal onto the speaker’s intentions? [e.g., Noveck & Posada, 2003; Huang & Snedeker, 2009; 2011; Grodner et al., 2010; Nieuland et al., 2010; Breheny et al., 2013a,b; Degen & Tanenhaus, 2015]

- One lens through which this has been studied is the contrastive inference. [e.g., Sedivy et al., 1999; Hanna & Tanenhaus, 2003; Kurumada et al., 2014]
Real-Time Pragmatic Inferences

Click on the large cup

Sedivy et al. (1999)
Real-Time Pragmatic Inferences

P(X | “large”)

Click on the large cup

Sedivy et al. (1999)
Research Questions

What’s the mechanism behind such fast inferences?

**Hypothesis 1**
- Store precompiled information about specific lexical items
- Retrieve that information to make inferences

**Hypothesis 2**
- Assess linguistic input with respect to a dynamic context
- Use that context to make inferences

Inferences must be **defeasible** when unwarranted in a given situation.
Speaker Reliability

Reliable speaker
- Adjective use only when necessary
- Correct labeling throughout experiment

Unreliable speaker
- Top-down instructions
- Repetitive, redundant adjective use (e.g., “the large red apple”)
- Mislabeling/wrong information (e.g., “toothbrush” for a hairbrush)

Grodner & Sedivy (2011)
Current Study

1) Experiment 1
   Conceptually replicating Grodner & Sedivy (2011) with
   ● a computer-based paradigm for precise stimulus control
   ● significantly fewer trials (200+ vs. 52)
   to establish that contrastive inferences are derived in context

2) Experiment 2
   Examining whether top-down information is necessary for
   speaker-based modulation of real-time pragmatic inferences
Experiment 1 Design

Reliable (24 Participants)

Reliable Instruction (top down)

Unreliable Instruction (top down)

Unreliable (24 Participants)

52 trials (bottom up)

36 reliable fillers

16 critical trials

36 unreliable fillers

52 trials (bottom up)
Top-down Instructions

Reliable

“The study is intended to measure how effectively people communicate in various situations…..”

Unreliable

“The study is intended to examine communicative aspects of the speaker’s language impairment…..”
### Filler Instructions

<table>
<thead>
<tr>
<th>Reliable</th>
<th>Unreliable</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 Informative</td>
<td>28 Over-informative</td>
</tr>
<tr>
<td>“Click on the large doll”</td>
<td>“Click on the large pretty doll”</td>
</tr>
<tr>
<td>Target</td>
<td>Contrast</td>
</tr>
<tr>
<td>Competitor</td>
<td>Distracter</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>4 Under-informative</td>
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<tr>
<td></td>
<td>“Click on the doll”</td>
</tr>
<tr>
<td></td>
<td>4 Mislabeled</td>
</tr>
<tr>
<td></td>
<td>“Click on the stuffed animal”</td>
</tr>
</tbody>
</table>
Prediction: Reliable, Two-contrast

Proportion of fixations

“Click on the large cup”
Prediction: Reliable, One-contrast

“Click on the large cup”
Prediction: Unreliable, One- & Two-contrast

Proportion of fixations

“Click on the large cup”
Results: Reliable, Two-contrast

“Click on the large cup”
Results: Reliable, One-contrast

“Click on the **large** cup”
Target Fixations

Proportion of target fixations

Reliable

1

2
Target Fixations

Proportion of target fixations

- Reliable
- Unreliable

1 2

n.s.
Experiment 1 → Experiment 2

- Results suggest contrastive inferences are modulated with respect to speaker reliability.

- Is the top-down information necessary for this modulation? Or is the bottom-up linguistic input sufficient?

- We test this by rerunning same Unreliable condition — without the explicit instructions that the speaker is unreliable.
Experiment 2 Design

Unreliable [Exp 2] (24 Participants)

Reliable Instruction (top down)

52 trials (bottom up)

36 unreliable fillers

16 critical trials
Target Fixations

- Reliable
- Unreliable_Exp1
- Unreliable_Exp2

Proportion of target fixations

<table>
<thead>
<tr>
<th></th>
<th>Reliable</th>
<th>Unreliable_Exp1</th>
<th>Unreliable_Exp2</th>
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<td>1.0</td>
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n.s. indicates non-significant differences.
## Target Fixations by Experiment Halves

<table>
<thead>
<tr>
<th>Proportion of target fixations</th>
<th>FIRST</th>
<th>SECOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliable</td>
<td><img src="chart1.png" alt="Bar Chart" /></td>
<td><img src="chart2.png" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Unreliable_Exp1 (with top-down)</td>
<td><img src="chart3.png" alt="Bar Chart" /></td>
<td><img src="chart4.png" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Unreliable_Exp2 (bottom-up only)</td>
<td><img src="chart5.png" alt="Bar Chart" /></td>
<td><img src="chart6.png" alt="Bar Chart" /></td>
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</table>

### Proportion of target fixations

- **Reliable**
- **Unreliable_Exp1 (with top-down)**
- **Unreliable_Exp2 (bottom-up only)**
Discussion

- Results suggest that contrastive inferences are generated online with respect to speaker reliability.

- These earliest inferences seem sensitive enough to change with bottom-up linguistic input alone.

- This all suggests that pragmatic mechanisms for efficient communication are dynamic and probabilistic.
Future work

● Does this truly illustrate judgments of a speaker’s pragmatic reliability?
  ○ Alternatively, do participants think there are experimental errors in the unreliable conditions?

● Morgan, Lawrence, and Kurumada (forthcoming) testing this by presenting two within-subject speaker of different reliabilities.
  ○ Different inference patterns for the two speakers would corroborate conclusions.
We appreciate your time!

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References