The Effects of Scale Type and Salience on the Interpretation of Scalar Implicature

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Grice: SAYING vs. IMPLICATING

What is SAID (1967/89)

• the truth-conditional meaning of a sentence ("closely related to the conventional meaning of the words…uttered")

• includes those contextual elements required for truth-conditional meaning (e.g., reference resolution, indexicals, disambiguation), henceforth NECESSARY CONTEXTUAL ELEMENTS (NCEs)
Grice: SAYING vs. IMPLICATING

What is IMPLICATED

CONVENTIONALLY vs. CONVERSATIONALLY

– CONVERSATIONAL IMPLICATURES
  • Generalized (GCIs) vs. Particularized (PCIs)
    ➢ GCIs, not PCIs, arise under normal circumstances
  • Cancelable
    ➢ Not part of truth-conditional meaning, i.e., not part of what is said
Scalar Implicatures

Grice’s Maxim of Quantity (Part 1):
– Make your contribution as informative as is required.

The Maxim of Quantity generates upper-bounding (“at most”) implicatures.
– The use of a scalar value implicates that higher values on the scale are false/unknown.
– $all > some$
– John ate some of the cake.
→ John did not eat all of the cake.
Canceling Scalar Implicatures

- Scalar implicatures exhibit differences in cancelability.
  - In Larson et al. 2007, we found differences in truth-value judgments across a broad range of GCI types.
  
- Implicatures generated by cardinals\(^1\) (e.g., \(2 \rightarrow \sim 3\)) were harder to cancel than those generated by gradable scalar adjectives (e.g., pretty \(\rightarrow \sim gorgeous\)).

\(^1\) The status of cardinals vis-à-vis scalar implicatures is controversial. See Horn (1992) and Geurts (1998) for further discussion.
Factors Affecting Cancelability

To what extent might various features of scalar implicatures affect judgments about truth conditions?
Factors Affecting Cancelability

• Two factors potentially affecting the cancelability of scalar implicatures:
  – Information structure (e.g., van Kuppevelt 1996)
  – Scale type (e.g., Kennedy & McNally 2005; Fox & Hackl 2006)
Information Structure

• Scalar implicatures are based on sets of ordered values (i.e., alternatives) such as \(<all, many, some>\).

• Alternatives may be evoked explicitly or implicitly in discourse:
  
  – **Explicitly evoked alternatives**
    A: Did John buy one, two, or three books?
    B: John bought one book.
  
  – **Implicitly evoked alternatives**
    A: How many books did John buy?
    B: John bought one book.
Scale Type

• Scales can be categorized according to:
  – **Boundedness** (e.g., Kennedy & McNally 2005)
  – **Density** (e.g., Fox & Hackl 2006)
Scale Boundedness

• A **closed** scale is bounded at both ends.
• An **open** scale is one that is not closed.
  – Kennedy and McNally (2005) use these properties to explain collocation of adverbs with gradable adjectives.
  • e.g., *fully* combines with closed scales but not with open scales (*fully open* vs. *#fully hot*).
Scale Density

- **Continuous scale:** for any two values, there exists an intermediate value.
- **Discrete scale:** one that is not continuous

Fox and Hackl (2006) argue that all ‘measurement scales’ relevant for language are continuous ("dense" in their terminology).
Goals of Our Study

• To examine whether and to what extent these three factors – information status of scales/alternative values, scale boundedness, and scale density – affect the inclusion of scalar implicatures as part of truth-conditional meaning.
Experimental Manipulations

Manipulated three factors:

**Scale type**

1. Boundedness: closed/open
2. Density: discrete/continuous

**Information structure**

3. Discourse status of alternative values
Scale Type Definitions for the Experiment

**Open:** Scales without an upper limit

**Closed:** Scales with limits at both ends

**Continuous:** Scales permitting intermediate values between any two points

**Discrete:** Scales that are not continuous

Combined both two-way distinctions to create four scale types
## Scale Types

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>&lt;…gorgeous, pretty, average-looking&gt;</td>
<td>&lt;all, many, some&gt;</td>
</tr>
<tr>
<td>Discrete</td>
<td>&lt;…3, 2, 1&gt;</td>
<td>&lt;and, or&gt;</td>
</tr>
</tbody>
</table>
Information Structure

Three possible statuses for alternative values:

– **Unevoked (U):** No member of the scale evoked
  • *How many books did John buy?*

– **One Evoked (O):** One member of the scale evoked
  • *Did John buy three books?*

– **All Evoked (A):** All members of the scale evoked
  • *Did John buy one, two, three books or more?*
Methods: Example Stimulus

Irene: How many children does Lisa have?

Sam: She has three children.

FACT: Lisa has quadruplets.

Given this FACT, Literal Lucy would say the underlined sentence is:

T or F

1 2 3 4
not at all confident completely confident
Experimental Materials

• Experimental items:
  – 48 scales, 12 of each of the 4 scale types (OC, CC, OD, CD)
  – 3 context versions (U, O, A) of each scale
    → 3x2x2 design with 144 items in all
  – Each participant read only 48 experimental items (one context version of each scale) - Latin Square

• Other items:
  – 20 fillers (deictics, ellipses, indexicals, non-scalar GCIs)
  – 14 entailments - expect high %True responses
  – 14 contradictions - expect low %True responses
Materials

• Irene’s question in the O-condition always used a term higher on the scale than Sam’s response.

  Irene: How many children does Lisa have?
  Sam: She has three children.

• Sam’s answer was the same across all versions (U, O, A).
Materials

• **FACT:**
  – Wording consistent across all versions of each conversation: All designed to cancel Sam’s implicature
  – None of the FACTs used values from the scales
  e.g., *<succeed, attempt>:*
    **Irene:** Did Daniel attempt to climb Mt. Hood or did he succeed?
    **Sam:** He attempted to climb it.
    **FACT:** Daniel climbed to the summit of Mt. Hood.
    → Daniel succeeded in climbing Mt. Hood
Truth-Value Judgment Paradigms

• In our earlier work (Doran et al. 2007), we identified problems with instructions used in previous experiments (e.g., use of technical terms) and proposed a new paradigm.

• **Literal Lucy paradigm**
  – Participants use their folk notion of literal interpretation to make judgments of truth-conditional meaning based on the external perspective of “Literal Lucy”, a literal-minded character.
Methods: Introducing Literal Lucy

• Literal Lucy interprets all language literally and misinterprets expressions such as figurative language and indirect speech acts.

• Participants were trained on the Literal Lucy paradigm with examples like:

  Frank: Hey, Lucy, can you tell me what time it is?
  Literal Lucy: Yes, I can!
  Frank: So...?

• After each conversation, participants were asked whether Literal Lucy would say that the underlined sentence was true.
Methods: Participants and Procedures

• Participants: 44 native speakers of North American English

• Testing took approximately 30-40 minutes.
## Interpreting the Data

<table>
<thead>
<tr>
<th>% of TRUE Responses</th>
<th>Fact Conflicts with Underlined Sentence?</th>
<th>S.I. Part of the Truth-Conditional Meaning?</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>LOW</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Irene:** How many children does Lisa have?

**Sam:** She has three children.

**FACT:** Lisa has quadruplets.
Overall Results

3x2x2 Repeated Measures ANOVA

• **Information Status**
  – Main effect: $F(2, 86) = 5.64, p < 0.01$

• **Density**
  – Main effect: $F(1, 43) = 45.57, p < 0.00$

• **Boundedness**
  – No main effect: $F(1, 43) = 2.48, p > 0.05$

• **Interactions**
  – Only Boundedness*Density significant:
    $F(1,42) = 32.74, p < 0.00$
Discussion: Information Status

- When multiple alternate values are evoked, participants seem more likely to include scalar implicature in truth-conditional meaning.

- None of the pairwise comparisons were significant.
Discussion: Density

- Importance of plausible intermediate values:
  - Intermediate scalar values could make scales less cohesive
    → easier to cancel the implicature
  - e.g., OC (gradable adjectives) vs. OD (cardinals)
Examples of Density (from Open Scales)

Open Continuous
Irene: How attractive is Kate?
Sam: She’s pretty.
FACT: Kate was voted World’s Most Beautiful Woman this year.

Open Discrete
Irene: How many bottles of beer did you bring over?
Sam: I brought five.
FACT: Sam brought a case of beer over.
Discussion: Interaction

- Both the OD*OC and CD*CC differences are significant, though in opposite directions.
- Density main effect driven by Open conditions.
- Closed conditions results could be due to other features of the scales in these conditions.
Examples from Closed Scales

**Closed Continuous**: e.g. `<always, frequently>`, `<top, middle>

Irene: How many of her classmates did Esther invite to her party?

Sam: She invited many of them.

**FACT**: Esther invited her whole class to her party.

**Closed Discrete**: e.g. `<succeed, attempt>`, `<and, or>

Irene: Undergraduates in which years can register for the advanced seminar?

Sam: Juniors can register.

**FACT**: Anyone who has completed his or her first year of studies can register for the advanced seminar.
Conclusions and Future Work

• Conclusions:
  – Information status of alternative values and scale type both affect the likelihood that a scalar implicature is included as part of truth-conditional meaning.
  – This relationship is complex with regards to scale type.

• Future work:
  – Examine individual items and refine scale types
  – Complement this strategic paradigm with more automatic paradigms (e.g., reading times)
Appendix

1. Closed Discrete Scales (CD)
<and, or>

**Unevoked**
Irene: How did Stan spend his bonus?
Sam: He bought a car or went to China.
FACT: Stan bought a car while on vacation in Beijing, China.

**One Evoked**
Irene: Did Stan buy a car and go to China?
Sam: He bought a car or went to China.
FACT: Stan bought a car while on vacation in Beijing, China.

**All Evoked**
Irene: Did Stan buy a car or go to China, or did he buy a car and go to China?
Sam: He bought a car or went to China.
FACT: Stan bought a car while on vacation in Beijing, China.

**Other Closed Discrete Scales:**
<succeed, attempt>, <senior, junior, sophomore, freshman>, <first class, business, economy>, <must, can>, <whole, 2%, 1%, skim>, <doctoral, master's, bachelor's>, <felony, misdemeanor, citation>, <king, queen, full, twin>, <4th, 3rd, 2nd, 1st degree>, <advanced, intermediate, beginner>, <find, look>
Appendix

2. Closed Continuous Scales (CC)

<all, most, some>

Unevoked
Irene: How much cake did Gus eat at his sister’s birthday party?
Sam: He ate most of it.
FACT: By himself, Gus ate his sister’s entire birthday cake.

One Evoked
Irene: Did Gus eat all of his sister’s birthday cake?
Sam: He ate most of it.
FACT: By himself, Gus ate his sister’s entire birthday cake.

All Evoked
Irene: Did Gus eat some, most, or all of his sister’s birthday cake?
Sam: He ate some of it.
FACT: By himself, Gus ate his sister’s entire birthday cake.

Other Closed Continuous Scales:
<everyone, many, a few>, <always, frequently, sometimes>, <top, middle, bottom>, <crossed the finish line, go around the bend, come out of the gate>, <permanently, a year, a month>, <…majority, several, a couple…>, <entire, a portion>, <shave, cut, trim>, <rarely, occasionally>, <completely, partially, somewhat>
Appendix

3. Open Discrete Scales (OD)
<…3, 2, 1>

Unevoked
Irene: How many books did Harry buy?
Sam: He bought two books.
FACT: Harry bought the Lord of the Rings trilogy.

One Evoked
Irene: Did Harry buy three books?
Sam: He bought two books.
FACT: Harry bought the Lord of the Rings trilogy.

All Evoked
Irene: Did Harry buy one, two, three books or more?
Sam: He bought two books.
FACT: Harry bought the Lord of the Rings trilogy.

Other Open Discrete Scales:
<…6, 5, 4…> roses, <…25, 10, 5…> Cents for candy, <…4, 3, 2…> children,
<…36, 24, 12…> doughnuts, <…20, 10, 5…> years married, <…100, 90, 80…>
basketball points, <…20, 10, 5…> cigarettes, <…6, 4, 2…> hours to cook a pot
roast, <…10, 9, 8…> cats, <…6, 5, 4…> beers, <…4, 3, 2…>
Appendix

4. Open Continuous Scales (OC)
<…gorgeous, pretty, average-looking>

Unevoked
Irene: How attractive is Kate?
Sam: She’s pretty.
FACT: Kate was voted World’s Most Beautiful Woman this year.

One Evoked
Irene: Is Kate gorgeous?
Sam: She’s pretty.
FACT: Kate was voted World’s Most Beautiful Woman this year.

All Evoked
Irene: Is Kate average-looking, pretty, or gorgeous?
Sam: She’s pretty.
FACT: Kate was voted World’s Most Beautiful Woman this year.

Other Open Continuous Scales:
<…huge, big, average…>, <…super-hot, medium-hot, mild…>, <…sweating, hot, warm…>, <wealthy, comfortable, poor\(^2\)>, <…furious, upset, annoyed…>, <…blaring, loud, audible…>, <…bawling, teary, misty…>, <…ecstatic, happy, content…>, <…smart, brilliant…>, <…obnoxious, annoying, irksome…>, <…snug, tight…>

2. This value will be replaced by a non-negative value in future studies. Thanks to Kristen Syrett for pointing this out that poor is a negative value.
References


