Exhaustivity is a conversational implicature

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1.1. The challenge: the epistemic step

(1) Of John, Bill and Mary, who came to the party?
- John came. \(\sim\) Mary and Bill didn’t. (exhaustivity)
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An implicature, the supposition of which is necessary for maintaining the assumption that the speaker is cooperative.
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   ...
3. She believes that they didn’t come.
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(1) Of John, Bill and Mary, who came to the party?
   - John came. \( \neg \text{Mary and Bill didn’t.} \) \hspace{1cm} (exhaustivity)

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An implicature, the supposition of which is necessary for maintaining the assumption that the speaker is cooperative.

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2. She didn’t, so she lacks the belief that they came.
   \[ \ldots \] \hspace{0.5cm} (‘the epistemic step’ - Sauerland, 2004)
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Wrong, it does!
1.2. Existing ‘Gricean’ approaches

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2. She lacks the belief that Mary came  (Quantity)
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Most existing work (from Mill, 1867 to Geurts, 2010):

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2. She lacks the belief that Mary came  (Quantity)
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   (Quantity)

3. She believes that Mary didn’t come

   ▶ It is empirically inadequate:

(2) I’m probably asking the wrong person, but of John, Bill and Mary, who came to the party?
   - John and Bill came. \(\sim\) *Not Mary.*
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- Opinionatedness must be something *conveyed by the speaker*. 
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▶ It is empirically inadequate:

(2) I’m probably asking the wrong person, but of John, Bill and Mary, who came to the party?
- John and Bill came. "Not Mary."

▶ Opinionatedness must be something *conveyed by the speaker*, but how?!
1.3. A non-Gricean approach

The grammatical approach:
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- There are invisible *exhaustivity operators* in our grammar.
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However (cf. Geurts, 2010):
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However (cf. Geurts, 2010):
- The insertion of EXH-operators is completely stipulated.
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All we can do is show that Grice *can* do it.
Part I: Exhaustivity à la Grice.
Yes we can!

Part II: Generativity à la Grice.
On cancellability, focus, and the final rise.
Part I: Exhaustivity à la Grice

2. Diagnosis
3. Theory
4. Results
5. Reflection
6. ‘Embedded’ implicatures
2. Diagnosis

(3) a. Of John, Bill and Mary, who came to the party?
   b. John came. ~ Mary didn’t come

Intuition (3b) and (3c) differ in their attentive content. (3c) draws attention to the poss. that Mary came too. (And so does (3a).) (3b) doesn’t; it leaves the possibility unattended. Apparently, pragmatic reasoning is sensitive to this.
2. Diagnosis

(3) a. Of John, Bill and Mary, who came to the party?
   b. John came.  
   c. John came, or Mary and John.  

\(\sim\) Mary didn’t come
\(\not\sim\) Mary didn’t come
2. Diagnosis

(3) a. Of John, Bill and Mary, who came to the party?
   b. John came.     \( \sim \) Mary didn’t come
   c. John came, or Mary and John. \( \not\vdash \) Mary didn’t come

Intuition
(3b) and (3c) differ in their *attentive content*. 
2. Diagnosis

\( (3) \) a. Of John, Bill and Mary, who came to the party?
    b. John came. \( \sim \text{Mary didn’t come} \)
    c. John came, or Mary and John. \( \nabla \text{Mary didn’t come} \)

**Intuition**

(3b) and (3c) differ in their *attentive content*.

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(3) a. Of John, Bill and Mary, who came to the party?
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(3b) and (3c) differ in their \textit{attentive content}.

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2. Diagnosis

(3) a. Of John, Bill and Mary, who came to the party?
   b. John came. \(\sim\) Mary didn’t come
   c. John came, or Mary and John. \(\nRightarrow\) Mary didn’t come

Intuition
(3b) and (3c) differ in their **attentive content**.

- (3c) draws attention to the poss. that Mary came too.
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    b. John came.                  \sim Mary didn’t come
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3. Theory

3.1. Translation into logic
3.2. Semantics
3.3. Pragmatics
3.1. Translation into logic

(4) a. Of John, Bill and Mary, who came to the party?
  b. John came.                      \( \sim \) Mary didn’t come
  c. John came, or Mary and John.    \( \lor \) Mary didn’t come
3.1. Translation into logic

(4) a. Of John and Mary, who came to the party?
   b. John came. \( \sim \) Mary didn’t come
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3.1. Translation into logic

(4) a. Of John and Mary, some came to the party.
   b. John came. \[\sim Mary \text{ didn’t come}\]
   c. John came, or Mary and John. \[\nabla Mary \text{ didn’t come}\]
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(4) a. John came, or Mary, or John and Mary.
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3.1. Translation into logic

(4) a. John came, or Mary, or John and Mary.
   b. John came.
   c. John came, or Mary and John.
3.1. Translation into logic

(4) a. John came, or Mary, or John and Mary. \( p \lor q \lor (p \land q) \)
b. John came. \( p \)
c. John came, or Mary and John. \( p \lor (p \land q) \)
3.2. Semantics (Roelofsen, 2011)
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- *Possibility*: a set of worlds \((a, b)\)
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- **Possibility**: a set of worlds \((a, b)\)
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\[
\begin{align*}
(4a) \ [p \lor q \lor (p \land q)] & \quad (4b) \ [p] & \quad (4c) \ [p \lor (p \land q)]
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\[(4a) \quad [p \lor q \lor (p \land q)] \] \\
\[(4b) \quad [p] \] \\
\[(4c) \quad [p \lor (p \land q)] \]

**Entailment**

\(A \text{ entails } B, A \models B, \text{ iff}\)

(i) \(\bigcup A \subseteq \bigcup B\); and

(ii) for all \(b \in B\), if \(b \cap \bigcup A \neq \emptyset\), \(b \cap \bigcup A \in A\)
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\begin{align*}
(4a) & \quad [p \lor q \lor (p \land q)] \\
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\(A\) entails \(B\), \(A \models B\), iff

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\rightarrow at least as informative
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(4a) \quad [p \lor q \lor (p \land q)]
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**Entailment**

\( A \) entails \( B \), \( A \models B \), iff

1. \( \bigcup A \subseteq \bigcup B \); and
2. for all \( b \in B \), if \( b \cap \bigcup A \neq \emptyset \), \( b \cap \bigcup A \in A \)

Now, \( (4c) \models (4a) \), but \( (4b) \nmodels (4a) \).
3.3. Pragmatics

The relevant maxims

1. Quality:
2. Quantity:
3. Relation:
3.3. Pragmatics

The relevant maxims
For a cooperative speaker with information $s$, responding $R$ to $Q$: 

1. **Quality:**
2. **Quantity:**
3. **Relation:**

- If it rained, John {went / didn't go}.
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The relevant maxims
For a cooperative speaker with information $s$, responding $R$ to $Q$:

1. **Quality**: $s \subseteq \bigcup R$.
2. **Quantity**:
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(5) Did John go to the party?
It was raining.
If it rained, John {went / didn’t go}. 
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For a cooperative speaker with information $s$, responding $R$ to $Q$:

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2. **Quantity**: For all $Q' \subseteq Q$, if $s \subseteq \bigcup Q'$ then $\bigcup R \subseteq \bigcup Q'$.
3. **Relation**: 

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(5) Did John go to the party?
It was raining.
The relevant maxims

For a cooperative speaker with information \( s \), responding \( R \) to \( Q \):

1. **Quality**: \( s \subseteq \cup R \).
2. **Quantity**: For all \( Q' \subseteq Q \), if \( s \subseteq \cup Q' \) then \( \cup R \subseteq \cup Q' \).
3. **Relation**: \( \{ r \cap s \mid r \in R \} \models Q \).

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If it rained, John {went / didn't go}.
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(5) Did John go to the party?
It was raining. \( \Rightarrow \) If it rained, John \{went / didn’t go\}. 

\[
\begin{array}{cccccc}
\text{rp} & \text{rp} & \text{r} & \text{p} & \text{rp} \\
\text{rp} & \text{rp} & \text{r} & \text{p} \\
\text{rp} & \text{rp} & \text{r} & \text{p} \\
\end{array}
= 
\begin{array}{cc}
\text{rp} & \text{rp} \\
\text{rp} & \text{rp} \\
\end{array} 
\models 
\begin{array}{cc}
\text{rp} & \text{rp} \\
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(5) Did John go to the party? It was raining.
If it rained, John \{went / didn't go\}. 
4. Results

4.1. Examples
4.2. Formal results
4.3. And more conceptually...
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

c. John came, or Mary and John. \((p \lor (p \land q))\)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)|\)  \(\text{(Quality)}\)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

   b. John came. \((p)\)

c. John came, or Mary and John. \((p \lor (p \land q))\)

   1. \(s \subseteq |p \lor (p \land q)| = |p|\) (Quality)
4.1. Examples

\[ (4) \quad \text{a. John came, Mary came, or both came } (p \lor q \lor (p \land q)) \]

\[ \text{b. John came. } (p) \]

\[ \text{c. John came, or Mary and John. } (p \lor (p \land q)) \]

1. \[ s \subseteq |p \lor (p \land q)| = |p| \] (Quality)
2. \[ s \not\subseteq |q| \] (Quantity)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)
   
b. John came. \((p)\)

c. John came, or Mary and John. \((p \lor (p \land q))\)
   1. \(s \subseteq |p \lor (p \land q)| = |p|\)  \hspace{1cm} \text{(Quality)}
   2. \(s \not\subseteq |q|\)

\[ p \lor (p \land q) \models p \lor q \lor (p \land q) \]
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\)  (Quality)
2. \(s \nsubseteq |q|\)  (Quantity)
3. \(p \lor (p \land q) \supseteq p \lor q \lor (p \land q)\)  (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\) (Quality)

---

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\) (Quality)

2. \(s \not\subseteq |q|\) (Quantity)

3. \(p \lor (p \land q) \supseteq p \lor q \lor (p \land q)\) (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\) \hspace{1cm} (Quality)
2. \(s \not\subseteq |q|\) \hspace{1cm} (Quantity)

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\) \hspace{1cm} (Quality)
2. \(s \not\subseteq |q|\) \hspace{1cm} (Quantity)
3. \(- p \lor (p \land q) \models p \lor q \lor (p \land q)\) \hspace{1cm} (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)
   1. \(s \subseteq |p|\)
   2. \(s \notin |q|\)

   \[p \not\in \, p \lor q \lor (p \land q)\] \hspace{1cm} \text{(Quality)}

   \(p \land q \subseteq \set{p, q}\) \hspace{1cm} \text{(Quantity)}


   c. John came, or Mary and John. \((p \lor (p \land q))\)
   1. \(s \subseteq |p \lor (p \land q)| = |p|\) \hspace{1cm} \text{(Quality)}
   2. \(s \notin |q|\) \hspace{1cm} \text{(Quantity)}
   3. \(p \lor (p \land q) \supseteq p \lor q \lor (p \land q)\) \hspace{1cm} \text{(Relation)}
4.1. Examples

(4) a. John came, Mary came, or both came \((p ∨ q ∨ (p ∧ q))\)

b. John came. \(p\)
1. \(s ⊆ |p|\)
2. \(s \notin |q|\)

\[ p \not\subseteq p ∨ q ∨ (p ∧ q) \]

(Quantity)

(4) c. John came, or Mary and John. \((p ∨ (p ∧ q))\)
1. \(s ⊆ |p ∨ (p ∧ q)| = |p|\)
2. \(s \notin |q|\)
3. \(p ∨ (p ∧ q) \not\subseteq p ∨ q ∨ (p ∧ q)\)

(Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)
   1. \(s \subseteq \vert p \vert\)
   2. \(s \not\subseteq \vert q \vert\)

   \(p \not\subseteq p \lor q \lor (p \land q)\)

   (Quality)
   (Quantity)

![Diagram](image1)

![Diagram](image2)

c. John came, or Mary and John. \((p \lor (p \land q))\)
   1. \(s \subseteq \vert p \lor (p \land q) \vert = \vert p \vert\)
   2. \(s \not\subseteq \vert q \vert\)
   3. \(p \lor (p \land q) \not\subseteq p \lor q \lor (p \land q)\)

   (Quality)
   (Quantity)
   (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)
   1. \(s \subseteq |p|\)
   2. \(s \not\subseteq |q|\)

\[ p \not\subseteq p \lor q \lor (p \land q) \]
\begin{align*}
\text{(Quality)} \quad \text{(Quantity)}
\end{align*}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{example_diagram}
\end{figure}

c. John came, or Mary and John. \((p \lor (p \land q))\)
   1. \(s \subseteq |p \lor (p \land q)| = |p|\)
   2. \(s \not\subseteq |q|\)
   3. \(\vdash p \lor (p \land q) \Rightarrow p \lor q \lor (p \land q)\)
\begin{align*}
\text{(Quality)} \quad \text{(Quantity)} \quad \text{(Relation)}
\end{align*}
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)
   1. \(s \subseteq |p|\)
   2. \(s \not\subseteq |q|\)

   \[ p \not\subseteq p \lor q \lor (p \land q) \]
   (Quality)
   (Quantity)


c. John came, or Mary and John. \((p \lor (p \land q))\)
   1. \(s \subseteq |p \lor (p \land q)| = |p|\)
   2. \(s \not\subseteq |q|\)
   3. - \(p \lor (p \land q) \models p \lor q \lor (p \land q)\)
   (Quality)
   (Quantity)
   (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)
   1. \(s \subseteq |p|\)
   2. \(s \not\subset |q|\)

\[
p \not\subset p \lor q \lor (p \land q)
\]

(Quantity)

(Quality)

\[
s \subseteq p \lor (p \land q) \subseteq p
\]

(Quantity)

(Quality)

(3) c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\)
2. \(s \not\subseteq |q|\)
3. \(- \quad p \lor (p \land q) \models p \lor q \lor (p \land q)\)

(Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq \lvert p \rvert\) \(\neq \lvert q \rvert\) \(\neq \lvert p \lor q \lor (p \land q) \rvert\) (Quality)
2. \(s \not\subseteq \lvert q \rvert\) (Quantity)
3. \(s \subseteq \lvert p \rvert \cup \lvert q \rvert\) or \(s \subseteq \lvert p \rvert \cup \lvert q \rvert\) (Relation)

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq \lvert p \lor (p \land q) \rvert = \lvert p \rvert\) (Quality)
2. \(s \not\subseteq \lvert q \rvert\) (Quantity)
3. \(p \lor (p \land q) \models p \lor q \lor (p \land q)\) (Relation)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\) \(\iff p \not\subseteq p \lor q \lor (p \land q)\) \(\text{(Quality)}\)
2. \(s \not\subseteq |q|\)
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |p| \cup |q|\) \(\text{(Relation)}\)

----------

(c. John came, or Mary and John. \((p \lor (p \land q))\))

1. \(s \subseteq |p \lor (p \land q)| = |p|\) \(\text{(Quality)}\)
2. \(s \not\subseteq |q|\)
3. \(-\ p \lor (p \land q) \models p \lor q \lor (p \land q)\) \(\text{(Relation)}\)
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\)  
2. \(s \not\subseteq |q|\)  
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |p| \cup |q|\)

Provides

4. \(s \subseteq |q|\)

---

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\)  
2. \(s \not\subseteq |q|\)  
3. \(p \lor (p \land q) \models p \lor q \lor (p \land q)\)

Provides

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\)  
2. \(s \not\subseteq |q|\)  
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |p| \cup |q|\)

Provides

4. \(s \subseteq |q|\)

---

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\)  
2. \(s \not\subseteq |q|\)  
3. \(p \lor (p \land q) \models p \lor q \lor (p \land q)\)

Provides
4.1. Examples

(4) a. John came, Mary came, or both came \((p \lor q \lor (p \land q))\)

b. John came. \((p)\)

1. \(s \subseteq |p|\)
2. \(s \not\subseteq |q|\)
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |p| \cup |q|\)

\[\frac{p \not\subseteq p \lor q \lor (p \land q)}{s \subseteq |q|\text{ exhaustivity!}}\]

4. \(s \subseteq |q|\)

---

c. John came, or Mary and John. \((p \lor (p \land q))\)

1. \(s \subseteq |p \lor (p \land q)| = |p|\)
2. \(s \not\subseteq |q|\)
3. \(- \quad p \lor (p \land q) \not\subseteq p \lor q \lor (p \land q)\)

\[\frac{p \lor (p \land q) \not\subseteq p \lor q \lor (p \land q)}{s \subseteq |q|\text{ exhaustivity!}}\]
4.2. Formal results

Recall: \( A \text{ entails } Q, \ A \models Q, \) iff
(i) \( \bigcup A \subseteq \bigcup Q; \) and
(ii) for all \( q \in Q, \ q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)
4.2. Formal results

Recall: $A$ entails $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature
For a cooperative speaker with info $s$, responding $A$ to $Q$: 
4.2. Formal results

Recall: $A$ entails $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature
For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $\bigcup A \cap s \subseteq \bigcup Q$
(ii) ...
4.2. Formal results

Recall: $A$ entails $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature

For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\bigcup A} \cup \bigcup Q$
(ii) ...
4.2. Formal results

Recall: $A$ *entails* $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature

For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\bigcup A} \cup \bigcup Q$
(ii) for all $q \in Q$,
4.2. Formal results

Recall: \( A \text{ entails } Q \), \( A \models Q \), iff
(i) \( \bigcup A \subseteq \bigcup Q \); and
(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature
For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):
(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)
(ii) for all \( q \in Q \), \( q \cap \bigcup A \cap s = \emptyset \) or \( \ldots \)
4.2. Formal results

Recall: A entails Q, \( A \models Q \), iff
(i) \( \bigcup A \subseteq \bigcup Q \); and
(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature

For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):
(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)
(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or …
4.2. Formal results

Recall: \( A \) entails \( Q \), \( A \models Q \), iff

(i) \( \bigcup A \subseteq \bigcup Q \); and

(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature

For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):

(i) \( s \subseteq \overline{\bigcup A \cup \bigcup Q} \)

(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A \cup \overline{q}} \) or there is an \( a \in A \) s.t. given \( s \), \( q \cap \bigcup A \) and \( a \) coincide.
4.2. Formal results

Recall: $A$ entails $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature

For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\bigcup A} \cup \bigcup Q$
(ii) for all $q \in Q$, $s \subseteq \overline{\bigcup A} \cup \overline{q}$ or there is an $a \in A$ s.t. $s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a)$
4.2. Formal results

Recall: *A entails Q*, $A \models Q$, iff
(i) $\cup A \subseteq \cup Q$; and
(ii) for all $q \in Q$, $q \cap \cup A = \emptyset$ or $q \cap \cup A \in A$

Relation implicature

For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\cup A} \cup \cup Q$
(ii) for all $q \in Q$, $s \subseteq \overline{\cup A} \cup \overline{q}$ or there is an $a \in A$ s.t. $s \subseteq (q \cap \cup A \cap \overline{a}) \cup (q \cap \cup A \cap a)$
4.2. Formal results

Recall: A entails Q, \( A \models Q \), iff
(i) \( \bigcup A \subseteq \bigcup Q \); and
(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature

For a cooperative speaker with info s, responding A to Q:
(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)
(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or there is an \( a \in A \) s.t.
\( s \subseteq (q \cap \overline{\bigcup A} \cap \overline{a}) \cup (q \cap \bigcup A \cap a) \)

Relation implicature for singleton answer

And if responding \( \{a\} \) to Q for some \( a \in Q \):

4.2. Formal results

Recall: \( A \) entails \( Q \), \( A \models Q \), iff

(i) \( \bigcup A \subseteq \bigcup Q \); and

(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature

For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):

(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)

(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or there is an \( a \in A \) s.t.

\[ s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a) \]

Relation implicature for singleton answer

And if responding \( \{a\} \) to \( Q \) for some \( a \in Q \):

For a cooperative speaker with info \( s \), responding \( \{a\} \) to \( Q \):

(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)

(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or there is an \( a \in A \) s.t.

\[ s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a) \]
4.2. Formal results

Recall: \( A \) entails \( Q \), \( A \models Q \), iff
(i) \( \bigcup A \subseteq \bigcup Q \); and
(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature
For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):
(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)
(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or there is an \( a \in A \) s.t. \( s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a) \)

Relation implicature for singleton answer
And if responding \( \{a\} \) to \( Q \) for some \( a \in Q \):
for all \( q \in Q \),
4.2. Formal results

Recall: $A$ entails $Q$, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature
For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\bigcup \overline{A} \cup \bigcup Q}$
(ii) for all $q \in Q$, $s \subseteq \overline{\bigcup \overline{A} \cup \overline{q}}$ or there is an $a \in A$ s.t.
$s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a)$

Relation implicature for singleton answer
And if responding $\{a\}$ to $Q$ for some $a \in Q$:
for all $q \in Q$, $s \subseteq \overline{a} \cup \overline{q}$ or ...
4.2. Formal results

Recall: *A entails Q*, $A \models Q$, iff

(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

**Relation implicature**

For a cooperative speaker with info $s$, responding $A$ to $Q$:

(i) $s \subseteq \overline{\bigcup A} \cup \bigcup Q$

(ii) for all $q \in Q$, $s \subseteq \overline{\bigcup A} \cup \overline{q}$ or there is an $a \in A$ s.t. $s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a)$

**Relation implicature for singleton answer**

And if responding \{a\} to $Q$ for some $a \in Q$:

for all $q \in Q$, $s \subseteq \overline{a} \cup \overline{q}$ or $s \subseteq (q \cap a \cap \overline{a}) \cup (q \cap a \cap a)$
4.2. Formal results

Recall: A entails Q, A ⊨ Q, iff
(i) \( \bigcup A \subseteq \bigcup Q \); and
(ii) for all \( q \in Q \), \( q \cap \bigcup A = \emptyset \) or \( q \cap \bigcup A \in A \)

Relation implicature

For a cooperative speaker with info \( s \), responding \( A \) to \( Q \):
(i) \( s \subseteq \overline{\bigcup A} \cup \bigcup Q \)
(ii) for all \( q \in Q \), \( s \subseteq \overline{\bigcup A} \cup \overline{q} \) or there is an \( a \in A \) s.t.
\( s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a) \)

Relation implicature for singleton answer

And if responding \( \{a\} \) to \( Q \) for some \( a \in Q \):
for all \( q \in Q \), \( s \subseteq \overline{a} \cup \overline{q} \) or \( s \subseteq \overline{a} \cup q \)
4.2. Formal results

Recall: A entails Q, $A \models Q$, iff
(i) $\bigcup A \subseteq \bigcup Q$; and
(ii) for all $q \in Q$, $q \cap \bigcup A = \emptyset$ or $q \cap \bigcup A \in A$

Relation implicature
For a cooperative speaker with info $s$, responding $A$ to $Q$:
(i) $s \subseteq \overline{\bigcup A} \cup \bigcup Q$
(ii) for all $q \in Q$, $s \subseteq \overline{\bigcup A} \cup \overline{q}$ or there is an $a \in A$ s.t.
$s \subseteq (q \cap \bigcup A \cap \overline{a}) \cup (q \cap \bigcup A \cap a)$

Relation implicature for singleton answer
And if responding $\{a\}$ to $Q$ for some $a \in Q$:
for all $q \in Q$, $s \subseteq \overline{a} \cup \overline{q}$ or $s \subseteq \overline{a} \cup q$
4.3. And more conceptually...

- The maxim of Relation requires that:
  for each possibility the speaker *leaves unattended*, the speaker
  knows how it depends on the information she provided.
4.3. And more conceptually...

- The maxim of Relation requires that:
  for each possibility the speaker *leaves unattended*, the speaker
  knows how it depends on the information she provided.
- Together with Quality, this implies *opinionatedness*. 
4.3. And more conceptually...

- The maxim of Relation requires that: for each possibility the speaker *leaves unattended*, the speaker knows how it depends on the information she provided.
- Together with Quality, this implies *opinionatedness*.
- Together with Quantity, this in turn yields exhaustivity.
4.3. And more conceptually...

- The maxim of Relation requires that: for each possibility the speaker \textit{leaves unattended}, the speaker knows how it depends on the information she provided.
- Together with Quality, this implies \textit{opinionatedness}.
- Together with Quantity, this in turn yields exhaustivity.

Main conclusion:
4.3. And more conceptually...

- The maxim of Relation requires that: for each possibility the speaker leaves unattended, the speaker knows how it depends on the information she provided.
- Together with Quality, this implies opinionatedness.
- Together with Quantity, this in turn yields exhaustivity.

Main conclusion:
- If pragmatic reasoning is sensitive to attentive content
4.3. And more conceptually...

- The maxim of Relation requires that: for each possibility the speaker leaves unattended, the speaker knows how it depends on the information she provided.
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Main conclusion:

- If pragmatic reasoning is sensitive to attentive content (which it must be, to distinguish between (3b) and (3c));
4.3. And more conceptually...

- The maxim of Relation requires that:
  for each possibility the speaker leaves unattended, the speaker knows how it depends on the information she provided.
- Together with Quality, this implies opinionatedness.
- Together with Quantity, this in turn yields exhaustivity.

Main conclusion:

- If pragmatic reasoning is sensitive to attentive content
  (which it must be, to distinguish between (3b) and (3c));
- then exhaustivity is a conversational implicature.
5. Reflection

5.1. ‘Alternatives’
5.2. Semantics
5.3. Semantic desiderata
5.4. ‘Gricean’?
5.1. ‘Alternatives’

Existing approaches (since forever):

- ‘Why did the speaker not say “\( p \land q \)”?’

Beware:

These ‘alternatives’ are fully determined by the maxims.

Speakers need not reason in terms of alternatives.
5.1. ‘Alternatives’

Existing approaches (since forever):
  ▶ ‘Why did the speaker not say “\(p \land q\)”?’
  ▶ Mere ignorance is sufficient reason.

Beware:
  ▶ These ‘alternatives’ are fully determined by the maxims.
  ▶ Speakers need not reason in terms of alternatives.
5.1. ‘Alternatives’

Existing approaches (since forever):

- ‘Why did the speaker not say “p ∧ q”?’
- Mere ignorance is sufficient reason.

My approach:

- ‘Why did the speaker not say “p ∨ (p ∧ q)”?’

Beware:

- These ‘alternatives’ are fully determined by the maxims.
- Speakers need not reason in terms of alternatives.
5.1. ‘Alternatives’

Existing approaches (since forever):
- ‘Why did the speaker not say “\( p \land q \)”?’
- Mere ignorance is sufficient reason.

My approach:
- ‘Why did the speaker not say “\( p \lor (p \land q) \)”?’
- *Ignorance is no excuse.*
5.1. ‘Alternatives’

Existing approaches (since forever):

- ‘Why did the speaker not say “p ∧ q”?’
- Mere ignorance is sufficient reason.

My approach:

- ‘Why did the speaker not say “p ∨ (p ∧ q)”?’
- *Ignorance is no excuse.*
- Hence something stronger is implied: exhaustivity.
5.1. ‘Alternatives’

Existing approaches (since forever):
- ‘Why did the speaker not say “\( p \land q \)”?’
- Mere ignorance is sufficient reason.

My approach:
- ‘Why did the speaker not say “\( p \lor (p \land q) \)”?’
- Ignorance is no excuse.
- Hence something stronger is implied: exhaustivity.

Beware:
- These ‘alternatives’ are fully determined by the maxims.
- Speakers need not reason in terms of alternatives.
5.2. Semantics

Restriction

A restricted to b, \( A_b := \{ a \cap b \mid a \in A, a \cap b \neq \emptyset \} \)

Semantics (Roelofsen, 2011)

1. \([p] = \{ \{ w \in \textbf{Worlds} \mid w(p) = \text{true} \} \}\)
2. \([\neg \varphi] = \{ \bigcup[\varphi] \} \) if \( \bigcup[\varphi] \) is nonempty; \( \emptyset \) otherwise.
3. \([\varphi \lor \psi] = (\{ \varphi \} \cup \{ \psi \})_{|\varphi| \cup |\psi|} = [\varphi] \cup [\psi] \)
4. \([\varphi \land \psi] = (\{ \varphi \} \cup \{ \psi \})_{|\varphi| \cap |\psi|} \)
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4. \([\varphi \land \psi] = ([\varphi] \cup [\psi])_{|\varphi|\cap|\psi|} \)

Attentive semantics is not the only suitable semantics:

- *Unrestricted Inquisitive Sem.* (Ciardelli, 2009; Westera, 2012)
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Attentive semantics is not the only suitable semantics:

- \textit{Unrestricted Inquisitive Sem.} (Ciardelli, 2009; Westera, 2012)

Minimally, the semantics must lack the \textit{absorption laws}:

- Absorption: \( p \lor (p \land q) \equiv p \equiv p \land (p \lor q) \)
5.3. Semantic desiderata

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- Questions, the responses to which may be exhaustified, are *not* partitions.
  (cf. Groenendijk and Stokhof, 1984; cf. ‘mention-some’).
- Wh-words are existential quantifiers over sets.
- ‘Some’, ‘most’ are fuzzy numerals:
  \[
  \exists x. \text{SOME}_P(x) \land P(x) \land Q(x)
  \]
5.4. ‘Gricean’?

“that there [appear to be] divergences in meaning between [...] the formal devices [and] their analogs or counterparts in natural language” (Grice, 1975)
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Besides: this is the only way.
6. ‘Embedded’ implicatures

6.1. Some examples
6.2. Diagnosis
6.3. Proof by whiteboard
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Exhaustivity that seems to ‘target’ an embedded position (Chierchia, *et al.* (2008)):
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(6) John, Mary or Bob came.
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Exhaustivity that seems to ‘target’ an embedded position (Chierchia, et al. (2008)):

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(7) Each of the students read Othello or King Lear.
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Intuition:

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The problem has never been the Gricean approach as such, but rather *how to find the right ‘alternatives’*. 
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Intuitively, in my account:

- The maxims are sensitive to attentive content.
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The problem has never been the Gricean approach as such, but rather *how to find the right* ‘alternatives’.

Intuitively, in my account:

- The maxims are sensitive to attentive content.
- Attentive content mirrors sub-sentential structure.
- (Hence so do the ‘alternatives’.)

Many ‘embedded’ implicatures are in fact predicted.
(6) John, Mary or Bob came.
   \[ \sim \text{Only one of them came.} \]

(7) Each of the students read Othello or King Lear.
   \[ \sim \text{Each of the students didn’t read both.} \]

(8) John believes that Bob read Othello or King Lear.
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Why it works:

- \textit{Attentively}, conjunction and disjunction denote \textit{union}.
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Why it works:

- Attentively, conjunction and disjunction denote union.
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(Of course more needs to be said regarding empirical data.)
End of Part I
Part II: Generativity à la Grice

7. Cancellability
8. Exhaustivity and Focus
9. Preventing exhaustivity: the final rise
7. Cancellability

7.1. Grice on cancellability
7.2. Textbook examples
7.3. Non-cancellable by definition
7.4. ‘Mandatory’ exhaustivity
7.1. Grice on cancellability

A putative conversational implicature that \( p \) is explicitly cancellable if [...] it is admissible to add “but not \( p \)”, or “I do not mean to imply that \( p \)” [...].

(Grice, 1975, p. 44.)
7.1. Grice on cancellability

A putative conversational implicature that $p$ is explicitly cancellable if [...] it is admissible to add “but not $p$”, or “I do not mean to imply that $p$” [...]. 

(Grice, 1975, p. 44.)

[...] since it is possible to opt out of the observation of [the Cooperative Principle], it follows that a conversational implicature can be cancelled in a particular case. (p.57)
7.2. Textbook examples

Some typical examples of cancellation:

(9) On an unrelated note, it was raining.

(10) John, or Mary, or both.

(11) Will one of your parents be home?

(12) How many people will be home?

Sure, one of them will be home. Indeed, both will be home.

In (11), the CI wasn't there to begin with...

(13) John or Mary. Oh, but I did not mean to imply not both.

(14) It is raining. Oh, but it has stopped!

The speaker is changing her mind...
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7.3. Non-cancellable by definition

- Surely CI are cancellable in a way that is *not* prevention, disambiguation or correction?
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For a consistent speaker to make a conversational implicature and subsequently cancel it.
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3. Hence, cancelling CI requires the sp. to retroactively:
   (i) revoke the cooperativity assumption; or
   (ii) revise what counted as cooperative.
4. The speaker would be either uncooperative, or inconsistent.
7.4. ‘Mandatory’ exhaustivity

In sum:

- Grice’s choice of the word ‘cancel’ is unfortunate.
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Now, if I’m correct:

- Exhaustivity is a conversational implicature.
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This makes the Gricean story much more generative...
8. Exhaustivity and focus

8.1. The focus principle
8.2. Focus vs. ‘only’
8.3. But... Zondervan!
8.4. But... other experiments!
8.1. The focus principle

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Focus principle (Beaver and Clark, 2008)
Some part of a declarative utterance must evoke all of the possibilities of the QUD.
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Some part of a declarative utterance **must** evoke all of the possibilities of the QUD.

Hence:

- Focus is necessary for Quan/Rel implicatures.
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Some part of a declarative utterance must evoke all of the possibilities of the QUD.

Hence:
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Some part of a declarative utterance must evoke all of the possibilities of the QUD.

Hence:
- Focus is necessary for Quan/Rel implicatures.
- Focus is (almost) sufficient for Quan/Rel implicatures.

The Gricean story is \textit{as generative as the grammatical approach}.
The foregoing is not to say that focus ‘means’ ‘only’:
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(15) If $[\text{John}]_F$ was there, Mary was there. (c.f., Horn, 1972)
    $\neq$ If only John was there, Mary was there.
8.2. Focus vs. ‘only’

The foregoing is not to say that focus ‘means’ ‘only’:

(15) If [John]$_F$ was there, Mary was there.  
     \(\neq\) If only John was there, Mary was there.

(16) [John]$_F$ was there, and [Mary]$_F$ too.  
     \(\neq\) Only John was there, and only Mary.
8.2. Focus vs. ‘only’

The foregoing is not to say that focus ‘means’ ‘only’:

(15) If $[\text{John}]_F$ was there, Mary was there. (c.f., Horn, 1972)
    $\not\equiv$ If only John was there, Mary was there.

(16) $[\text{John}]_F$ was there, and $[\text{Mary}]_F$ too.
    $\not\equiv$ Only John was there, and only Mary.

However, for ‘simple’ sentences:

$\triangleright$ ‘$[\text{Subject}]_F$ predicate’ $\not\sim$ ‘only $[\text{Subject}]_F$ predicate’.
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring?
   A: Harry brought \([\text{bread or chips}]_F\).

(18) Q: Who brought bread or chips?
   A: \([\text{Harry}]_F\) brought bread or chips.

His findings in a nutshell:

His findings in a nutshell:

no effect on exhaustivity.

However:

He compared the wrong focus structures.

(19) Q: What did Harry bring?
   A: Harry brought \([\text{bread}]_F\) or \([\text{chips}]_F\).

(20) Q: Did Harry bring bread and chips?
   A: Harry brought \([\text{bread}]_F\) or \([\text{chips}]_F\).

All theories predict exh. not for (17), but for (19) and (20).
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring?
    A: Harry brought [bread or chips]$_F$.

(18) Q: Who brought bread or chips?
    A: [Harry]$_F$ brought bread or chips.

His findings in a nutshell: \textit{no effect on exhaustivity}. 
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring?
   A: Harry brought [bread or chips]_F.

(18) Q: Who brought bread or chips?
   A: [Harry]_F brought bread or chips.

His findings in a nutshell: *no effect on exhaustivity*.

However:

- He compared the *wrong focus structures*.
8.3. But… Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring (bread/chips; booze; or party hats)?
   A: Harry brought \([\text{bread or chips}]]_F.

(18) Q: Who brought bread or chips?
   A: \([\text{Harry}]]_F brought bread or chips.

His findings in a nutshell: *no effect on exhaustivity.*

However:

- He compared the *wrong focus structures.*
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring (bread/chips; booze; or party hats)?
   A: Harry brought \([\text{bread or chips}]_F\).

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   A: \([\text{Harry}]_F\) brought bread or chips.

His findings in a nutshell: *no effect on exhaustivity*.

However:

- He compared the *wrong focus structures*.

(19) Q: What did Harry bring?
   A: Harry brought \([\text{bread}]_F\) or \([\text{chips}]_F\).
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring (bread/chips; booze; or party hats)?
   A: Harry brought \([\text{bread or chips}]_F\).

(18) Q: Who brought bread or chips?
   A: \([\text{Harry}]_F\) brought bread or chips.

His findings in a nutshell: *no effect on exhaustivity.*

However:

- He compared the *wrong focus structures.*

(19) Q: What did Harry bring?
   A: Harry brought \([\text{bread}]_F\) or \([\text{chips}]_F\).

(20) Q: Did Harry bring bread and chips?
   A: Harry brought bread \([\text{or}]_F\) chips.
8.3. But... Zondervan!

Zondervan (2010) experimentally compares two focus structures:

(17) Q: What did Harry bring (bread/chips; booze; or party hats)?
   A: Harry brought [bread or chips]_F.

(18) Q: Who brought bread or chips?
   A: [Harry]_F brought bread or chips.

His findings in a nutshell: *no effect on exhaustivity*.

However:

> He compared the *wrong focus structures*.

(19) Q: What did Harry bring?
   A: Harry brought [bread]_F or [chips]_F.

(20) Q: Did Harry bring bread and chips?
   A: Harry brought bread [or]_F chips.

> All theories predict exh. not for (17), but for (19) and (20).
8.4. But... other experiments!

In general, experimental results are mixed because:
  ▶ QUD and/or focus are left implicit;
8.4. But... other experiments!

In general, experimental results are mixed because:

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In general, experimental results are mixed because:

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8.4. But... other experiments!

In general, experimental results are mixed because:

- QUD and/or focus are left implicit;
- Domain restriction is left implicit (cf. *mention some*);
- Level of granularity is left implicit;
- Intonation is not controlled for.
8.4. But... other experiments!

In general, experimental results are mixed because:
- QUD and/or focus are left implicit;
- Domain restriction is left implicit (cf. *mention some*);
- Level of granularity is left implicit;
- The experimental task may disable maxims;
- Intonation is not controlled for.
9. Preventing exhaustivity: the final rise

9.1. Puzzle & proposal
9.2. Deriving the readings
9.3. General results
9.4. Outlook
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
John came↘.
~ Mary and Bill didn’t.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
    John came↗.

Mary and Bill didn’t.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
    John came↗.
    ↘ Mary and Bill didn’t.
    ~> ...wait, there’s more.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
John came↗.

comings

Mary and Bill didn’t.

comings

...wait, there’s more.

comings

...perhaps that implies sth. about M&B?
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
    John came↗.
    \(\not\) Mary and Bill didn’t.
    ∼ ...wait, there’s more.
    ∼ ...perhaps that implies sth. about M&B?
    ∼ ...but I’m not sure.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
John came↗.        Mary and Bill didn’t.

¬ ¬ ...wait, there’s more.
¬ ¬ ...perhaps that implies sth. about M&B?
¬ ¬ ...but I’m not sure.
¬ ¬ ...did I make myself clear?
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
   John came $\rightarrow^L$.
   $\rightarrow$ Mary and Bill didn’t.
   $\rightarrow$ ...wait, there’s more.
   $\rightarrow$ ...perhaps that implies sth. about M&B?
   c. John came $\rightarrow^H$.
   $\rightarrow$ ...but I’m not sure.
   $\rightarrow$ ...did I make myself clear?
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
   John came \( \nearrow^{L} \). \( \nearrow \) Mary and Bill didn’t.
   \( \nearrow \) …wait, there’s more.
   \( \nearrow \) …perhaps that implies sth. about M&B?
   c. John came \( \nearrow^{H} \).
      \( \nearrow \) …but I’m not sure.
      \( \nearrow \) …did I make myself clear?
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?

John came \( \rightarrow L \).  
\( \sim \) ...wait, there’s more.  
\( \sim \) ...perhaps that implies sth. about M&B?  
\( \sim \) ...but I’m not sure.

\( \sim \) ...did I make myself clear?

Mary and Bill didn’t.

\( \sim \) ...perhaps that implies sth. about M&B? (Relation)

\( \sim \) ...but I’m not sure.

\( \sim \) ...did I make myself clear?
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
    John came \( \rightarrow \uparrow L \).  \( \uparrow \) Mary and Bill didn’t.
    \( \sim \) ...wait, there’s more.  (Quantity)
    \( \sim \) ...perhaps that implies sth. about M&B?  (Relation)
    c. John came \( \rightarrow \uparrow H \).
    \( \sim \) ...but I’m not sure.
    \( \sim \) ...did I make myself clear?

Proposal

1. The final rise marks the violation of a maxim.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
   John came $\uparrow^L$.  $\not\leftarrow$ Mary and Bill didn’t.
   $\sim \ldots$ wait, there’s more.  (Quantity)
   $\sim \ldots$ perhaps that implies sth. about M&B?  (Relation)
   c. John came $\uparrow^H$.
      $\sim \ldots$ but I’m not sure.  (Quality)
      $\sim \ldots$ did I make myself clear?

Proposal

1. The final rise marks the violation of a maxim.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
    John came $\rightarrow^L$.                $\not\rightarrow$ Mary and Bill didn’t.
    $\sim \ldots$ wait, there’s more.     (Quantity)
    $\sim \ldots$ perhaps that implies sth. about M&B?   (Relation)
    c. John came $\rightarrow^H$.
        $\sim \ldots$ but I’m not sure.    (Quality)
        $\sim \ldots$ did I make myself clear?   (Manner)

Proposal

1. The final rise marks the violation of a maxim.
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?
   John came $\Rightarrow^L$.  \(\not\Rightarrow\)  Mary and Bill didn’t.
   \(\Rightarrow\)  ...wait, there’s more.  \(\Rightarrow\)  ...perhaps that implies sth. about M&B?  \(\Rightarrow\)
   c. John came $\Rightarrow^H$.
   \(\Rightarrow\)  ...but I’m not sure.  \(\Rightarrow\)  ...did I make myself clear?

Proposal

1. The final rise marks the violation of a maxim.
2. Its pitch conveys the severity of the violation:
   $\Rightarrow^H$: Quality/Manner;  \(\Rightarrow^L\): Quantity/Relation.  \(\Rightarrow\)  (cf. Ward & Hirschberg, 1992; Banziger & Scherer, 2005)
9.1. Puzzle & proposal

(21) Of John, Bill and Mary, who came to the party?

John came \( \rightarrow^L \). \( \triangleright \) Mary and Bill didn’t.

\( \sim \) ...wait, there’s more. \( \rightarrow \) (Quantity)

\( \sim \) ...perhaps that implies sth. about M&B? \( \rightarrow \) (Relation)

C. John came \( \rightarrow^H \).

\( \sim \) ...but I’m not sure. \( \rightarrow \) (Quality)

\( \sim \) ...did I make myself clear? \( \rightarrow \) (Manner)

Proposal

1. The final rise marks the violation of a maxim.

2. Its pitch conveys the severity of the violation:

\( \rightarrow^H \): Quality/Manner; \( \sim \) (cf. Ward & Hirschberg, 1992;

\( \rightarrow^L \): Quantity/Relation. \( \sim \) Banziger & Scherer, 2005)

This proposal is new in its generality, not in spirit.
9.2. Deriving the readings

(21) Of J and M, who came to the party? \( (p \lor q \lor (p \land q)) \)
John came \( \uparrow \).
9.2. Deriving the readings

(21) Of J and M, who came to the party? \( (p \lor q \lor (p \land q)) \)
John came ↗.

Readings

...wait, there’s more. \( (\text{Quantity}) \)
...perhaps that implies sth. about Mary? \( (\text{Relation}) \)
...but I’m not sure. \( (\text{Quality}) \)
...did I make myself clear? \( (\text{Manner}) \)
9.2. Deriving the readings

(21) Of J and M, who came to the party? 

John came. 

1. \(s \subseteq |p|\) 
2. \(s \notin |q|\) 
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |\overline{p} \cup \overline{q}|\)

Readings

...wait, there’s more. (Quantity)
...perhaps that implies sth. about Mary? (Relation)
...but I’m not sure. (Quality)
...did I make myself clear? (Manner)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \( (p \lor q \lor (p \land q)) \)
John came \(\rightarrow\).
1. \( s \subseteq |p| \) (Quality)
2. \( s \notin |q| \) (Quantity)
3. \( s \subseteq |p| \cup |q| \) or \( s \subseteq |p| \cup |q| \) (Relation)
4. The speaker thinks she is clear, concise, etc. (Manner)

Readings

...wait, there’s more. (Quantity)
...perhaps that implies sth. about Mary? (Relation)
...but I’m not sure. (Quality)
...did I make myself clear? (Manner)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)

John came \(\uparrow\).

1. \(s \notin |p|\)
2. \(s \notin |q|\)
3. \(s \subseteq |p| \cup |q|\) or \(s \subseteq |p| \cup |q|\)
4. The speaker thinks she is clear, concise, etc.

Readings

...wait, there’s more. \((\text{Quantity})\)

...perhaps that implies sth. about Mary? \((\text{Relation})\)

...but I’m not sure. \((\text{Quality})\)

...did I make myself clear? \((\text{Manner})\)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)

John came \(\uparrow\).

1. \(s \notin |p|\)
2. \(s \notin |q|\)
3. \(s \subseteq |p\cup q|\) or \(s \subseteq |\overline{p}\cup \overline{q}|\)
4. The speaker thinks she is clear, concise, etc.

Readings

...wait, there’s more. \((\text{Quantity})\)

...perhaps that implies sth. about Mary? \((\text{Relation})\)

✓ ...but I’m not sure. \((\text{Quality})\)

...did I make myself clear? \((\text{Manner})\)
9.2. Deriving the readings

(21) Of J and M, who came to the party? 
\[(p \lor q \lor (p \land q))\]  
\[(p)\]
John came ↗.

1. \(s \subseteq |p|\)  
   \[(\text{Quality})\]
2. \(s \not\subseteq |q|\)  
   \[(\text{Quantity})\]
3. \(s \subseteq \overline{|p| \cup |q|}\) or \(s \subseteq \overline{|p| \cup |q|}\)  
   \[(\text{Relation})\]
4. The speaker thinks she is clear, concise, etc.  
   \[(\text{Manner})\]

Readings

...wait, there’s more.  
\[(\text{Quantity})\]
...perhaps that implies sth. about Mary?  
\[(\text{Relation})\]
✓ ...but I’m not sure.  
\[(\text{Quality})\]
✓ ...did I make myself clear?  
\[(\text{Manner})\]
9.2. Deriving the readings

(21) Of J and M, who came to the party?
    John came upwards.

1. $s \subseteq |p|$  
2. $s \subseteq |q|$  
3. $s \subseteq \overline{|p|} \cup |q|$ or $s \subseteq \overline{|p|} \cup \overline{|q|}$  
4. The speaker thinks she is clear, concise, etc.

Readings

...wait, there’s more.  
...perhaps that implies sth. about Mary?  
✓ ...but I’m not sure.  
✓ ...did I make myself clear?
9.2. Deriving the readings

(21) Of J and M, who came to the party?  
John came $\rightarrow$.

1. $s \subseteq |p|$  
2. $s \subseteq |q|$  
3. $s \subseteq |p| \cup |q|$ or $s \subseteq |p| \cup |q|$  
4. The speaker thinks she is clear, concise, etc.

Readings

✓ ...wait, there’s more.  
   ...perhaps that implies sth. about Mary?  
✓ ...but I’m not sure.  
   ...did I make myself clear?
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)
   John came \(\uparrow\).

   1. \(s \subseteq |p|\)  
   2. \(s \notin |q|\)  
   3. \(s \subseteq \overline{|p| \cup |q|}\) or \(s \subseteq \overline{|p| \cup |q|}\)  
   4. The speaker thinks she is clear, concise, etc.

Readings

✓ ...wait, there’s more.  
   ...perhaps that implies sth. about Mary?  
✓ ...but I’m not sure.  
   ...did I make myself clear?
9.2. Deriving the readings

(21) Of J and M, who came to the party? \( (p \lor q \lor (p \land q)) \)

John came ↗.

1. \( s \subseteq |p| \) (Quality)
2. \( s \nsubseteq |q| \) (Quantity)
3. \( s \nsubseteq |p| \cup |q| \) and \( s \nsubseteq |\overline{p} \cup \overline{q}| \) (↑)
4. The speaker thinks she is clear, concise, etc. (Manner)

Readings

✓ ...wait, there’s more. (Quantity)
   ...perhaps that implies sth. about Mary? (Relation)
✓ ...but I’m not sure. (Quality)
   ...did I make myself clear? (Manner)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)  
John came \(\uparrow\).  
1. \(s \subseteq \vert p \vert\)  
2. \(s \nsubseteq \vert q \vert\)  
3. \(s \nsubseteq \overline{\vert p \vert \cup \vert q \vert}\) and \(s \nsubseteq \overline{\vert p \vert \cup \vert q \vert}\)  
4. The speaker thinks she is clear, concise, etc.  

Readings

✓ ...wait, there’s more.  
✓ ...perhaps that implies sth. about Mary?  
✓ ...but I’m not sure.  
    ...did I make myself clear?
9.2. Deriving the readings

(21) Of J and M, who came to the party? $(p \lor q \lor (p \land q))$

John came $\rightarrow$.

1. $s \subseteq |p|$ (Quality)
2. $s \nsubseteq |q|$ (Quantity)
3. $s \subseteq \overline{p} \lor |q|$ or $s \subseteq \overline{p} \lor \overline{|q|}$ (Relation)
4. The speaker thinks she is clear, concise, etc. (Manner)

Readings

✓ ...wait, there’s more. (Quantity)
✓ ...perhaps that implies sth. about Mary? (Relation)
✓ ...but I’m not sure. (Quality)
   ...did I make myself clear? (Manner)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)

John came ↗.

1. \(s \subseteq |p|\) (Quality)
2. \(s \not\subseteq |q|\) (Quantity)
3. \(s \subseteq \overline{|p|} \cup |q|\) or \(s \subseteq \overline{|p|} \cup \overline{|q|}\) (Relation)
4. The speaker doesn’t think she’s clear, concise, etc. (↗)

Readings

✓ ...wait, there’s more. (Quantity)
✓ ...perhaps that implies sth. about Mary? (Relation)
✓ ...but I’m not sure. (Quality)
   ...did I make myself clear? (Manner)
9.2. Deriving the readings

(21) Of J and M, who came to the party? \((p \lor q \lor (p \land q))\)

John came \(\uparrow\).

1. \(s \subseteq |p|\)  
   (Quality)
2. \(s \not\subseteq |q|\)  
   (Quantity)
3. \(s \subseteq \overline{|p|} \cup |q|\) or \(s \subseteq \overline{|p|} \cup \overline{|q|}\)  
   (Relation)
4. The speaker doesn’t think she’s clear, concise, etc.  
   (\(\uparrow\))

Readings

✓ ...wait, there’s more.  
   (Quantity)
✓ ...perhaps that implies sth. about Mary?  
   (Relation)
✓ ...but I’m not sure.  
   (Quality)
✓ ...did I make myself clear?  
   (Manner)
9.3. General results

My approach unifies existing approaches:
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- Quality: ‘lack of belief in proposition expressed’
  (Truckenbrodt, 2006)
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My approach unifies existing approaches:

- Quality: ‘lack of belief in proposition expressed’
  (Truckenbrodt, 2006)

- Relation: ‘uncertain relevance’/‘scalar uncertainty’
  (Ward & Hirschberg, 1985)

Manner reading: Usually treated as a side-effect.

Over-all: The reproductive precision is uncanny.
Attentive content is crucial for the Relation readings.
9.3. General results

My approach unifies existing approaches:

- **Quality**: ‘lack of belief in proposition expressed’
  
  (Truckenbrodt, 2006)

- **Relation**: ‘uncertain relevance’/‘scalar uncertainty’
  
  (Ward & Hirschberg, 1985)

- **Relation**: ‘rise-fall-rise quantifies over focus alternatives’
  
  (Constant, 2012)

- **Quantity**: ‘unfinishedness’ (Bartels, 1999)

- **Manner reading**: Usually treated as a side-effect.

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- Quantity: ‘unfinishedness’
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- Manner reading: Usually treated as a side-effect.

Over-all:

- The reproductive precision is *uncanny*.
- Attentive content is crucial for the Relation readings.
9.4. Outlook

Contrastive topic (Büring, 2003):

(9) [John] CT had the [beans] F.

Interrogatives:

(10) a. Was John there ↗
    b. Was John there ↘

Future work!
9.4. Outlook

Contrastive topic (Büring, 2003):

(9) $[\text{John}]_{CT}$ had the $[\text{beans}]_{F}$.
Contrastive topic (Büring, 2003):

(9) \([\text{John}]_{CT} \text{ had the } [\text{beans}]_{F}.\)

Interrogatives:

(10) a. Was John there ↗?
    b. Was John there ↘?
9.4. Outlook

Contrastive topic (Büring, 2003):

(9) \([\text{John}]_{F\uparrow} \text{ had the } [\text{beans}]_{F\downarrow}\).

Interrogatives:

(10) a. Was John there\(\uparrow\)?
    b. Was John there\(\downarrow\)?
9.4. Outlook

Contrastive topic (Büring, 2003):

(9) $\text{[John]}_{F \uparrow}$ had the $\text{[beans]}_{F \downarrow}$.

Interrogatives:

(10) a. Was John there $\uparrow$?
    
b. Was John there $\downarrow$?

Future work!
End of Part II
10. The bigger picture

If pragmatic reasoning is sensitive to attentive content then exhaustivity is a conversational implicature. 'Embedded' implicatures are no problem.

Conversational implicatures are not really cancellable. Focus makes it even more generative. The final rise is awesome.
10. The bigger picture

Part I: Exhaustivity à la Grice

- If pragmatic reasoning is sensitive to *attentive content*
10. The bigger picture

Part I: Exhaustivity à la Grice

- If pragmatic reasoning is sensitive to *attentive content*
- then *exhaustivity is a conversational implicature.*
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Part I: Exhaustivity à la Grice

- If pragmatic reasoning is sensitive to *attentive content*
- then *exhaustivity is a conversational implicature*.
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Part II: Generativity à la Grice

- Conversational implicatures are not really cancellable.
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Part I: Exhaustivity à la Grice

- If pragmatic reasoning is sensitive to 
  attentive content
- then exhaustivity is a conversational implicature.
- ‘Embedded’ implicatures are no problem.

Part II: Generativity à la Grice

- Conversational implicatures are not really cancellable.
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10. The bigger picture

Part I: Exhaustivity à la Grice

- If pragmatic reasoning is sensitive to *attentive content*
- then *exhaustivity is a conversational implicature*.
- ‘Embedded’ implicatures are no problem.

Part II: Generativity à la Grice

- Conversational implicatures are not really cancellable.
- Focus makes it even more generative.
- The final rise is *awesome*. 
The End

Articles

- *Exhaustivity through the maxim of Relation* (LENLS proceedings, see staff.science.uva.nl/~westera/)
- ‘Attention, I’m violating a maxim!’
  (submitted, available through me)

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Appendix A. Other maxims of Relation

i. $R_s \models Q$  

ii. $R_{CG} \models Q$  (Roberts’s (1996) contextual entailment)

iii. $R_h \models Q$  ($\approx$ GS’s (1984) pragmatic answer)

ii. and iii. are too strong:  

The participants need not already know how $R$ is relevant.  

They need only be able to figure it out.  

(5) Did John go to the party? It was raining.  

If it rained, John {went / didn’t go}.
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Appendix B. Relatedness and knowledge

$R_s \models Q$ ‘the speaker knows how $R$ is related to $Q$’
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\[ R_s \models Q \quad \text{‘the speaker knows how } R \text{ is related to } Q’ \]

**Relatedness**

A is *related* to \( Q \) in world \( w \) iff for some fact \( f, w \in f, A_f \models Q \).

\[(\text{e.g., let } f = \{w\})\]
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\[ R_s \models Q \quad \text{‘the speaker knows how } R \text{ is related to } Q \text{’} \]

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A is related to Q in world w iff for some fact f, \( w \in f \), \( A_f \models Q \).

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Within a world, everything is related.
Appendix C. Logical relatedness

Just as [logical consequence] rules the validity of argumentation, [logical relatedness] rules the coherence of information exchange.

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(22) Dogs and cats are mammals. (Logical cons.)
Dogs are mammals.

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Relatedness
A is related to Q in world w iff for some fact f, w ∈ f, A ⊆ f/uni22A7 Q.

Logical iff f captures all and only the laws of logic.

Non-logical iff f is a contingency.
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Logical consequence is logical relatedness.
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It was raining $\downarrow$. $\Rightarrow$ He {likes / dislikes} rainy parties
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The maxims can be (and have been) defined in two ways:

- **Objective**: Say only what is true, relevant, etc.
- **Subjective**: Say only what you think is true, relevant, etc.

My account of the final rise relies on subjective maxims:

- Violating 'say only what you think is true' = uncertainty
- Violating 'say only what is true' = lying

But an account based on objective maxims would also work:

- Final rise: 'For some maxim, I'm not sure whether or how I comply with it'.
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Example given by Fox (forthcoming):

(25) There’s money in box A or in box B!

\((p \lor q)\)

\(\sim\) Not in both.
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1. \[ s \subseteq \left| p \right| \cup \left| q \right| \] \hspace{1cm} (Quality)
2. - \hspace{1cm} (Quantity disabled)
3. \[ s \subseteq \left| p \cup q \right| \cup (\left| p \cap q \right|) \text{ or } s \subseteq \left| p \cup q \right| \cup \left| p \cap q \right| \] \hspace{1cm} (Relation)
4. Comply with the maxims transparently. \hspace{1cm} (Manner)
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7. \(s \subseteq \overline{|p| \cap |q|}\) \quad (from 5 and 6)
References (i)

- Geurts (2010). Quantity implicatures.
References (ii)