Scalar Implicature

Examples

Scalar implicatures (SIs) are inferences like (1)–(3)

(1) `The linguist speaks Korean or Japanese.`

➠ The linguist doesn't speak both

(2) `Some of the syntacticians are sad.`

➠ Not all of the syntacticians are sad

"Or" doesn't entail "not both"

(1) The linguist speaks Korean or Japanese.

➠ The linguist doesn't speak both

This inference is not part of the lexical meaning of "or"

(2) The linguist speaks K or J and not both.

(3) a. The linguist doesn't speak K or J.

b. I know no linguist that speaks K or J.

(4) You need to speak K or J.

"Some" doesn't entail "not all"

(1) Some of the syntacticians are sad.

➠ Not all of the syntacticians are sad

This inference is not part of the lexical meaning of "some"

(2) Some but not all of the syntacticians are sad.

(3) a. Unless some of my friends come, I won't go.

b. The teacher denied that some of her students cheated.

(4) You need to take some of the intro courses.

Research questions

Expressions that give rise to SIs are often called **scalar expressions** (or 'scalars')

If SIs are not part of the lexically encoded meanings of scalar expressions, where do they come from?

- **Pragmaticists**: SIs are pragmatic inferences
- **Grammaticalists**: SIs are due to a phonologically null operator (Exh/$\mathcal{O}$)

Terminological note

- Griceans claim that SIs are a type of pragmatic inference called **implicature** that involves **scales**, e.g. ⟨or, and⟩, ⟨some, (most,) all⟩, ⟨possible, certain⟩
- Some neo-Griceans (e.g., Geurts 2010) use the term **quantity implicature**
  - The Gricean derivation of a SI refers to the **Maxim of Quantity**
  - Quantitiy implicatures are a broader concept, subsuming those cases not involving 'scales', e.g., *ad hoc* implicatures
- For grammaticalists (e.g., Chierchia, Fox & Spector 2011), SIs are not 'implicatures', but they still use the term 'scalar implicature'

Roadmap

1 Gricean approach

2 Some theoretical issues

- 2.1 Primary vs. secondary implicatures
- 2.2 The Symmetry Problem
- 2.3 Embedded scalar implicatures

3 Grammatical approach

1 Gricean approach

Pragmatic inferences

Not all meaning is encoded in linguisitc expressions

```
(1)  Q: Do you speak Korean or Japanese?
     A: My sister speaks Korean.
```

One naturally concludes from (1A) that the speaker does not speak Korean (and more)

But this inference is arguably not part of the meaning of the linguistic expressions used

```
(2)  Q: Who else in your family speaks an Asian language?
     A: My sister speaks Korean.
```

Gricean implicature

Paul Grice pioneered the study of pragmatic inferences

- **Idea**: With the assumption that the speaker is **cooperative**, one draws inferences based on their (linguistic or non-linguistic) behaviour
- Grice called such pragmatic inferences **implicatures**

Cooperativity

It's reasonable to assume that conversational agents are generally **cooperative**

Pragmatic inferences arise in non-linguistic communication as well

They can be analysed as implicatures too.

> (1) A: Do you have a lightning cable?
> B: (Shows her Android phone)
> ➠ B doesn't have an iPhone and doesn't have a lightning cable

Gricean Maxims

What does it mean to be cooperative?

Grice's (tentative) answer: To be a cooperative agent is to follow:

- **Maxim of Quantity**: Be informative
- **Maxim of Quality**: Only say what you believe to be true
- **Maxim of Relation**: Don't say irrelevant things
- **Maxim of Manner**: Make your utterance orderly

Maxim of Quantity

The Maxim of Quantity is about **informativity**

- Sub-maxim 1: Don't be underinformative
- Sub-maxim 2: Don't be overinformative

```
(1)  A:  What are you reading?
     B1: A novel.
     B2: Animal Farm.
     B3: p. 46 of Animal Farm.
```

Gricean derivation of SI: Or

1. Utterance: "I speak Korean or Japanese"
2. Why didn't the speaker say "I speak Korean **and** Japanese"?
    - That would have been more informative
    - "I speak K and J" asymmetrically entails "I speak K or J"
    - Therefore the Maxim of Quantity favours this alternative
3. It must be because asserting the alternative would have been uncooperative
    - The Maxims of Relation and Manner would have been respected
    - It must have flouted the Maxim of Quality
    - Therefore, the speaker doesn't believe the alterantive to be true

Gricean derivation of SI: Some

1. Utterance: "Some of the cats are asleep"
2. Why didn't the speaker say "**All** of the cats are asleep"?
    - That would have been more informative
    - Therefore the Maxim of Quantity favours this alternative
3. It must be because asserting the alternative would have been uncooperative
    - The Maxims of Relation and Manner would have been respected
    - It must have flouted the Maxim of Quality
    - Therefore, the speaker doesn't believe the alterantive to be true

Summary

(Neo-)Griceans claim that SIs are **implicatures**, a type of pragmatic inference generated on the cooperativity assumptions

Recipe for SI:

1. Identify a more informative (stronger) **alternative** (e.g., "and" for "or", "all" for "some")
2. Gricean reasoning about Quantity and Quality leads to the negation of the alternative

According to this theory, an SI arises via counterfactual reasoning about a hypothetical utterance of a more informative alternative

Exercise: More SIs

(1) `It's possible that it'll rain tomorrrow.`

➠ It's not certain that it'll rain tomorrow

(2) `Not all the cats are asleep.`

➠ Some cats are asleep.

(3) `The linguist wanted to go to Paris.`

➠ The linguist didn't go to Paris

(4) `A: Do you speak foreign languages?`
`B: I speak Dutch and Russian.`

➠ B doesn't speak any other foreign language.

Controversial cases

(1) `The professor has two PhD students.`

➠ The professor does not have three or more PhD students

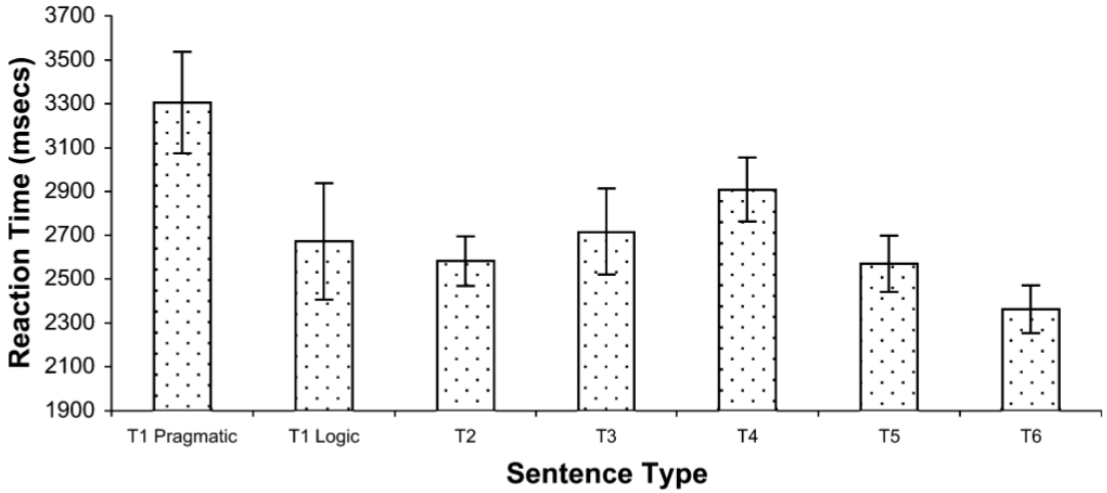
(2) `This jacket has pockets.`

➠ The jacket has more than one pocket.

Bott & Noveck 2004: Experiment 3

Sentence	Example	Mean proportion True
T1	Some elephants are mammals	0.407 (.120)
T2	Some mammals are elephants	0.887 (.018)
T3	Some elephants are insects	0.073 (.012)
T4	All elephants are mammals	0.871 (.021)
T5	All mammals are elephants	0.031 (.006)
T6	All elephants are insects	0.083 (.017)

Note. Scores are based on $N = 32$ participants where each participant was required to evaluate 9 instances of each type of sentence. Outlier responses are not included. Variance is shown in parentheses.



2 Some research topics

2.1 Primary vs. sencodary implicature

According to the Gricean approach:

- Uttering the alternative ψ would have violated the Maxim of Quality
- The Maxim of Quality says: Only utter things you believe to be true, i.e. you have enough evidence for
- So the derived inference is: The speaker does not have enough evidence for the truth of ψ (**primary implicature**)

But the preceived SI is typically stronger than this: The speaker has enough evidence for the falsity of ψ (**secondary implicature**)

Epistemic Step

1. **Primary implicature**: $\neg B_s(\psi)$
2. **Secondary implicature**: $B_s(\neg\psi)$

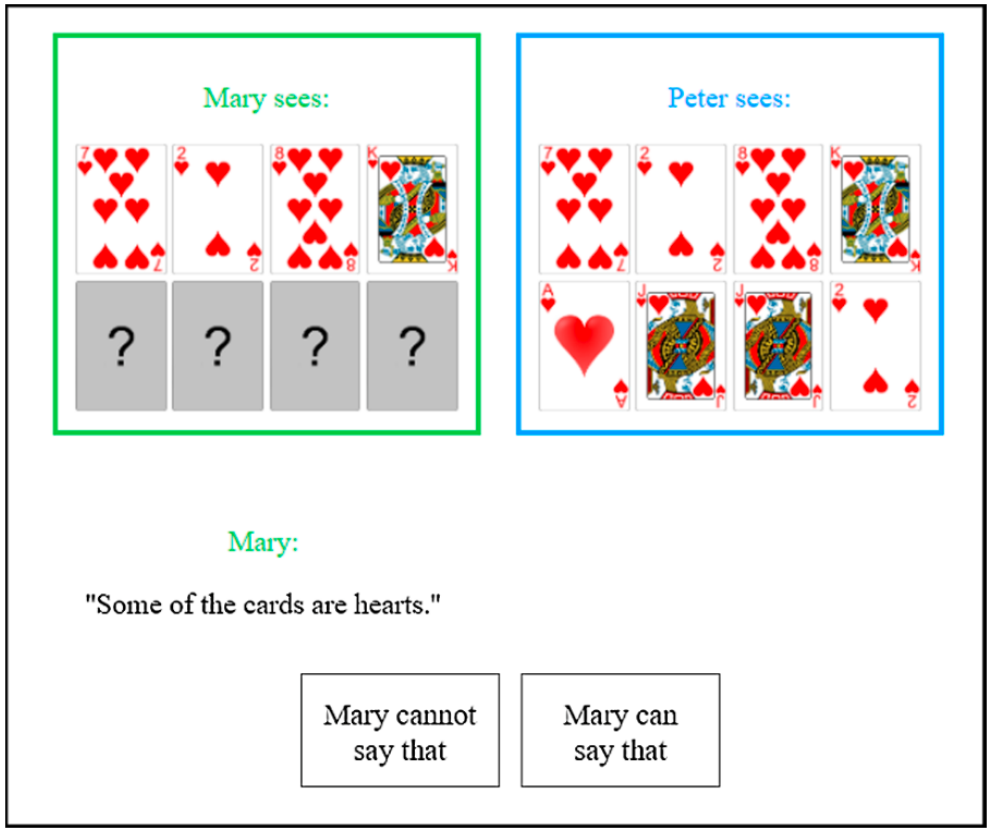
Neo-Gricean (Spector 2003, Sauerland 2004, etc.) assume that a primary implicature gets strengthened to a secondary implicature via an auxiliary assumption, **Opinionatedness** (alt. Experthood, Competence)

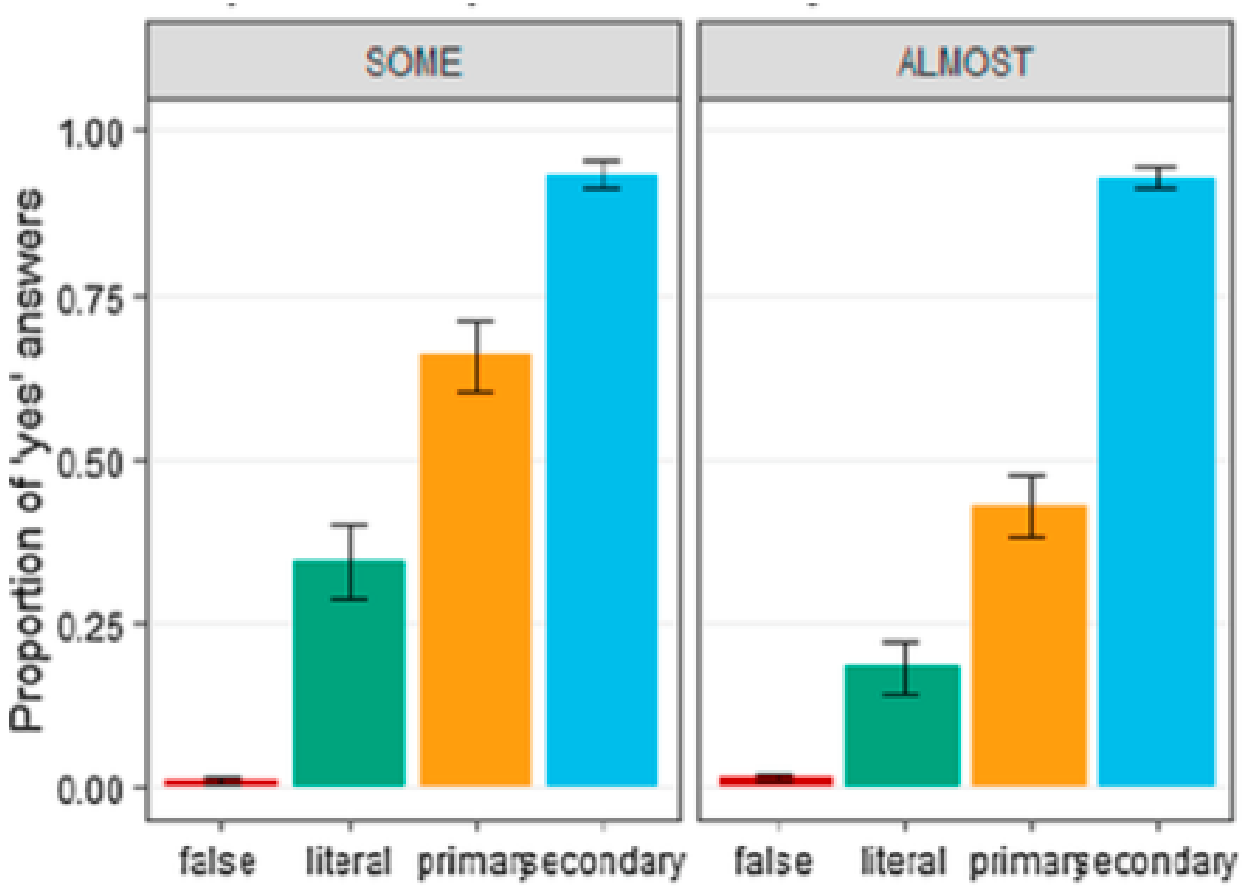
3. **Opinionatedness**: $B_s(\psi) \vee B_s(\neg\psi)$

1. + 3. $\Rightarrow$ 2.

But some experimental evidence that secondary SIs are drawn even if Opinionatedness does not hold (i.e., the speaker is known to be uncertain)

Dieuleveut, Chemla & Spector 2014: Experiment 2





2.2 The Symmetry Problem

Classical Gricean theories are naive about alternatives

```
(1) Some of the cats are asleep.
```

The crucial alternative is formed with "all", but one could think of another alternative formed with "some but not all" or "only some"

```
(2)  a. All of the cats are asleep.
     b. Some but not all of the cats are asleep.
```

These alternatives are called **symmetric alternatives**

Symmetric alternatives cannot be both negated consistently, while maintaining the truth of the prejacent

Structural complexity

One might think that the symmetry between "all" and "some but not all" can be broken by the difference in **structural complexity** (see Katzir 2007)

> Alternatives are formed by deleting a constituent or replacing a constituent by a lexical item or contextually salient expression

But not all symmetry problems can be explained by structural complexity (Romoli 2013, Trinh & Haida 2015, Breheny et al. 2018)

```
(1) Not all of the cats are asleep.
    a. None of the cats are asleep.
    b. Some of the cats are asleep.
```

2.3 Embedded SIs

Gricean derivations of SIs only apply at the utterance level

But SIs seem to be able to take scope under logical operators (Chierchia 2004, Chierchia, Fox & Spector 2011, etc.)

```
(1)  a. Someone flunked some of the intro courses.
     b. If you order a starter or a dessert with your meal, you'll
        pay £12. If you order both, you'll pay £15.
     c. The student is under the impression that she is required to
        take syntax or semantics.
```

Experimental research on SIs

- Geurts & Pouscoulous 2009 failed to observe evidence for embedded SIs
- Chemla & Spector 2011 found some evidence
- More work: Geurts & Van Tiel 2013, Cummins 2014, Van Tiel 2014, Potts, Lassiter, Levy & Frank 2014, Franke, Schlotterbeck & Augurzky 2017, Noveck & Kissine 2018

Difficulties

- By assumption SIs don't arise under 'negative operators'
- With a positive operator over a scalar expression, the local SI reading would asymmetrically entail the global SI reading; crucial data comes from rejections

Non-monotonic contexts

```
(1)  a. Exactly 4 students flunked some of the intro courses.
     b. An even number of students flunked some of the intro
        courses.
```

- E.g., the global reading is true and the local reading false, when 3 students flunked some but not all, 1 flunked all
- Note that these sentences might lack the global reading altogether

NB: The global and local readings amount to the same thing for 'exactly one'

```
(2) Exactly one student flunked some of the intro courses.
```

3 Grammatical Approach

Exh

The grammatical approach to SI was developed mainly to deal with embedded SIs

SIs are triggered by a phonologically null operator called '**Exh**' (Groenendijk & Stokhof 1984, Chierchia 2004, Van Rooij & Schulz 2004, Chierchia, Fox & Spector 2011)

$$[\![\mathbf{Exh}\ \varphi]\!](w) = 1 \Leftrightarrow [\![\varphi]\!](w) = 1 \wedge \forall \psi \in \mathsf{Alt}(\varphi)[\mathsf{Cond}(\psi, \varphi) \rightarrow [\![\psi]\!](w) = 0]$$

- φ is called the **prejacent**
- $\mathsf{Alt}(\varphi)$ is the set of (relevant) alternatives to φ
- $\mathsf{Cond}(\psi, \varphi)$ is some condition on ψ given φ
  - ψ is stronger than φ (i.e. ψ entails ϕ but ϕ doesn't entail ψ)
  - ψ is non-weaker than φ (i.e., φ doesn't entail ψ)
  - ψ is 'innocently excludable' given φ

Disjunctive alternatives

```
(1) Alex took Syntax or Semantics
    Conjunctive-alt: Alex took Syntax and Semantics
    Disjunct-alt-1: Alex took Syntax
    Disjunct-alt-2: Alex took Semantics
```

The disjunct-alts are used to derive the ignorance inference (= primary implicatures)

They sometimes give rise to SIs

```
(2) Alex needs to take syntax or semantics
    Conjunctive-alt: Alex needs to take syntax and semantics
    Disjunct-alt-1: Alex needs to take syntax
    Disjunct-alt-2: Alex needs to take semantics
```

Innocent exclusion

The disjunctive-alts are stronger (and hence non-weaker) than the prejacent, but negating them independently will contradict the prejacent

Fox 2007 puts forward **innocent exclusion**: Negate as many alternatives as possible, while maintaining consistency with the prejacent

$$\mathsf{IE}(\varphi) := \bigcap \max \mathsf{Excl}_\varphi$$

- $\mathsf{Excl}_\varphi := \{S \subseteq \mathsf{Alt}(\varphi) | \exists w[\overline{S}(w) = [\![\varphi]\!](w) = 1]\}$
- $\overline{S}(w) = 1 :\Leftrightarrow \forall \psi \in S[[\![\psi]\!](w) = 0]$
- $\max X = \{x \in X | \neg \exists y \in X[x \subset y]\}$

E.g. $\mathsf{IE}(\text{A or B}) = \{\text{A and B}\}$; $\mathsf{IE}(\text{need A or B}) = \{\text{need A}, \text{need B}, \text{A and B}\}$

Remarks

- Exh is similar to *only*, but not Strawson-DE so does not license weak NPIs
- When Exh appears under an opeartor, the SI takes scope below the operator
- Exh is anti-licensed under negation. There might be other distributional constraints (Fox & Spector 2018)
- The grammatical approach is compatible with Gricean Pragmatics, including certain pragmatic inferences (e.g., ignorance implicatures as primary implicatures)
- The burden of proof is on the grammaticalist
  - Embedded SIs (Chierchia 2004, Chierchia, Fox & Spector 2011)
  - Obligatory SIs (Chierchia 2004, 2013, etc.)
  - Multiple SIs (Franke & Bergen 2020)

Summary

- In most theories of SI, generation of a scalar implicature involves:
    i. Reference to an **alternative**
    ii. Negate the alternative
- Theories mostly differ with respect to the negation mechanism
    - Gricean: Reasoning about Quantity and Quality
    - Grammatical: Exh
- Two experimental topics
  A) Implicature priming
  B) Scalar diversity