Signalling Games and Pragmatics

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The course

- concentrates on **Gricean Pragmatics**,
- is concerned with the foundation of pragmatics on **Lewis (1969) theory of Conventions**,
- uses **classical game theory**!

The course

- is **introductory!**

The course is

- **not** an introduction to the economic literature on signalling games (cheap talk, market signals, pragmatics of debate, credibility).
- **not** concerned with the evolution of language structure and its use

  $\Rightarrow$ no evolutionary game theory!

Other misleading expectations

Signalling Games and Pragmatics is not related to:

- Wittgenstein's Language Games.
- Game Theoretic Semantics (Hintikka).

Overview

- Day 1: Introduction: From Grice to Lewis
- Day 2: Basics of Game and Decision Theory
- Day 3: Two Theories of Implicatures (Parikh, Jäger)
- Day 4: Best Answer Approach
- Day 5: Utility and Relevance

From Grice to Lewis

Day 1 – August, 7th

Overview

- Gricean Pragmatics
  - General assumptions about conversation
  - Conversational implicatures
- Game and Decision Theory
- Lewis on Conventions
  - Examples of Conventions
  - Signalling conventions
  - Meaning in Signalling systems

Gricean Pragmatics

General assumptions about conversation

A simple picture of communication

- The speaker encodes some proposition p
- He sends it to an addressee
- The addressee decodes it again and writes p in his knowledgebase.

- Problem: We communicate often much more than we literally say!

  Some students failed the exam.

  +> Most of the students passed the exam.

Gricean Pragmatics

Grice distinguishes between:

- What is **said**.
- What is **implicated**.

"Some of the boys came to the party."

- **said:** At least two of the boys came to the party.
- **implicated:** Not all of the boys came to the party.

Both part of what is **communicated**.

Assumptions about Conversation

- Conversation is a **cooperative effort**.
- Each participant recognises in the talk exchange a **common purpose**.
- A stands in front of his obviously immobilised car.

  A: I am out of petrol.

  B: There is a garage around the corner.
- **Joint purpose of B's response**: Solve A's problem of finding petrol for his car.

The Cooperative Principle

Conversation is **governed by a set of principles** which spell out how rational agents behave in order to make language use efficient.

The most important is the so-called **cooperative principle**:

"Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged."

The Conversational Maxims

Maxim of Quality:

1. Do not say what you believe to be false.
2. Do not say that for which you lack adequate evidence.

Maxim of Quantity:

1. Make your contribution to the conversation as informative as is required for he current talk exchange.
2. Do not make your contribution to the conversation more informative than necessary.

Maxim of Relevance:

Make your contributions relevant.

Maxim of Manner:

Be perspicuous, and specifically:

1. Avoid obscurity.
2. Avoid ambiguity.
3. Be brief (avoid unnecessary wordiness).
4. Be orderly.

The Conversational Maxims
(short, without Manner)

Maxim of Quality: Be truthful.

Maxim of Quantity:

1. Say as much as you can.
2. Say no more than you must.

Maxim of Relevance: Be relevant.

The Conversational Maxims

Be truthful (Quality) and say as much as you can (Quantity) as long as it is relevant (Relevance).

Conversational implicatures

An example: Scalar Implicatures

"Some of the boys came to the party."

- **said:** At least two of the boys came to the party.
- **implicated:** Not all of the boys came to the party.

Both part of what is communicated.

An Explanation based on Maxims

Let A(x) ≡ “x of the boys came to the party”

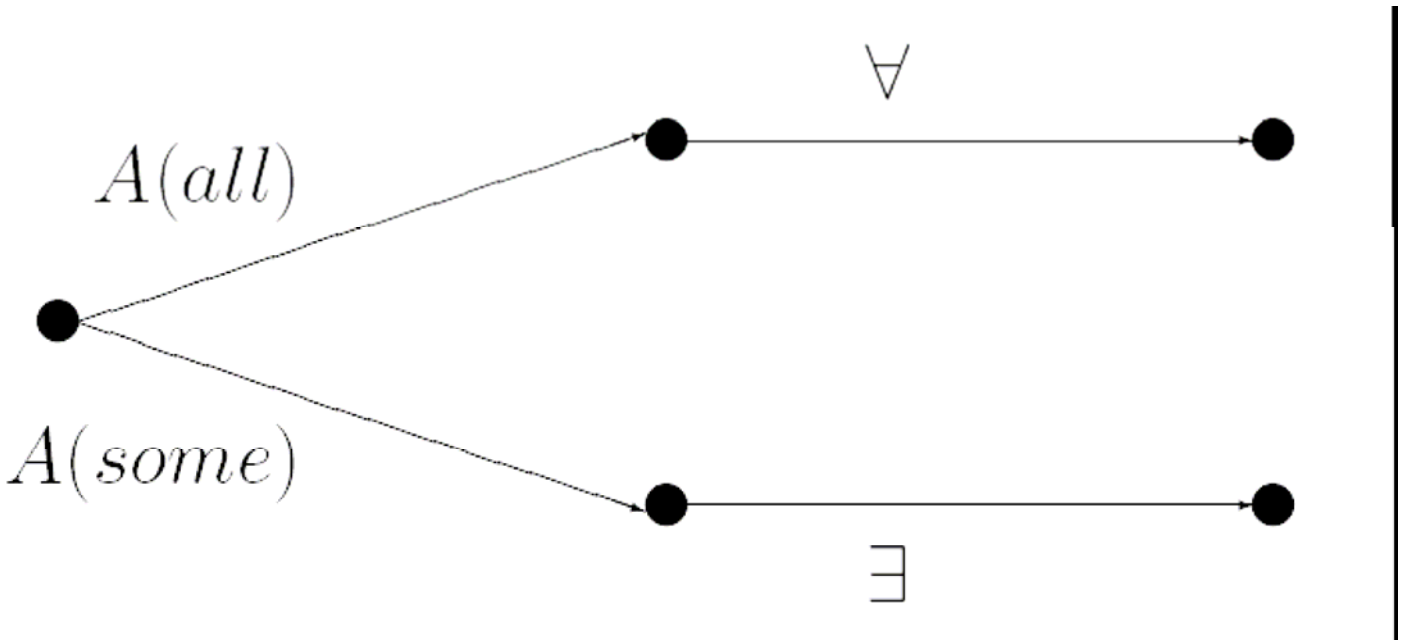
1. The speaker had the choice between the forms A(all) and A(some).
2. A(all) is more informative than A(some) and the additional information is also relevant.
3. Hence, if all of the boys came, then A(all) is preferred over A(some) (Quantity) + (Relevance).

4. The speaker said A(some).
5. Hence it cannot be the case that all came.
6. Therefore some but not all came to the party.

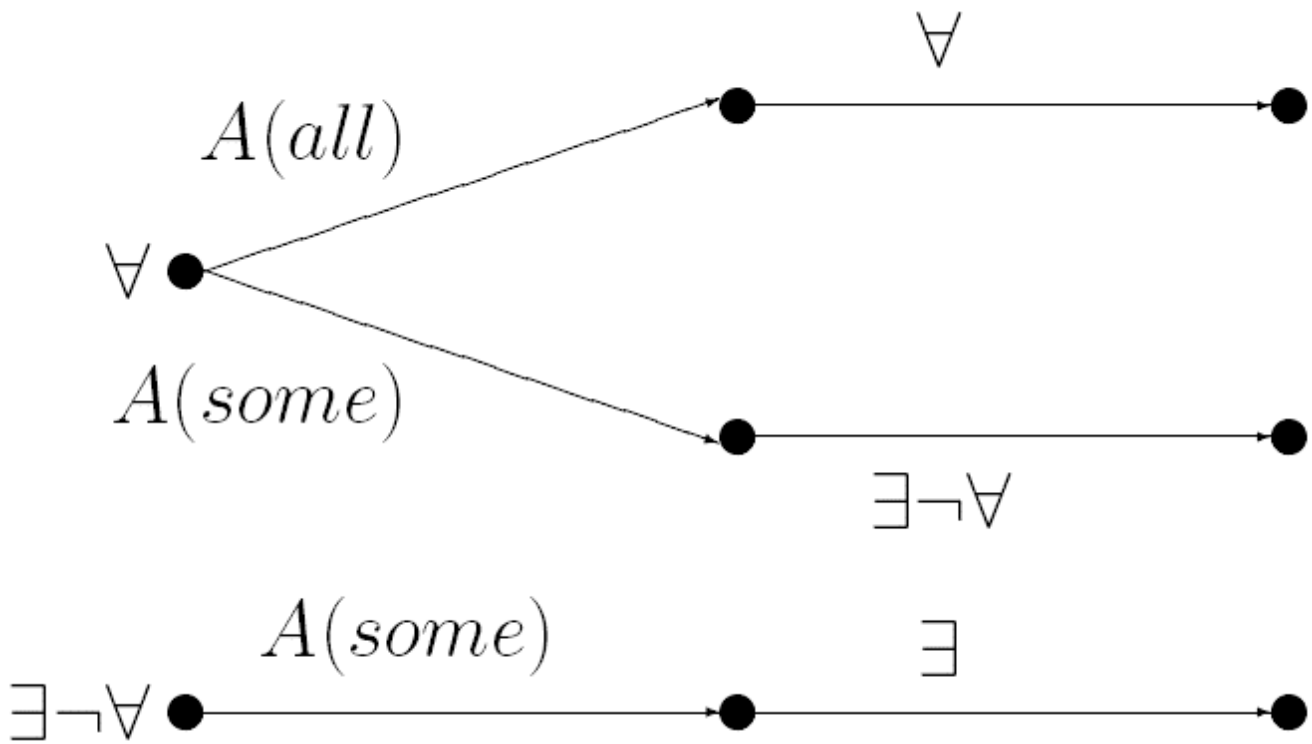
A Graphical Interpretation I

- The speaker has a choice between A(all) and A(some).
- If he chooses A(all), the hearer has to interpret ‘all’ by the universal quantifier.
- If he chooses A(some), the hearer has to interpret ‘some’ by the existential quantifier.

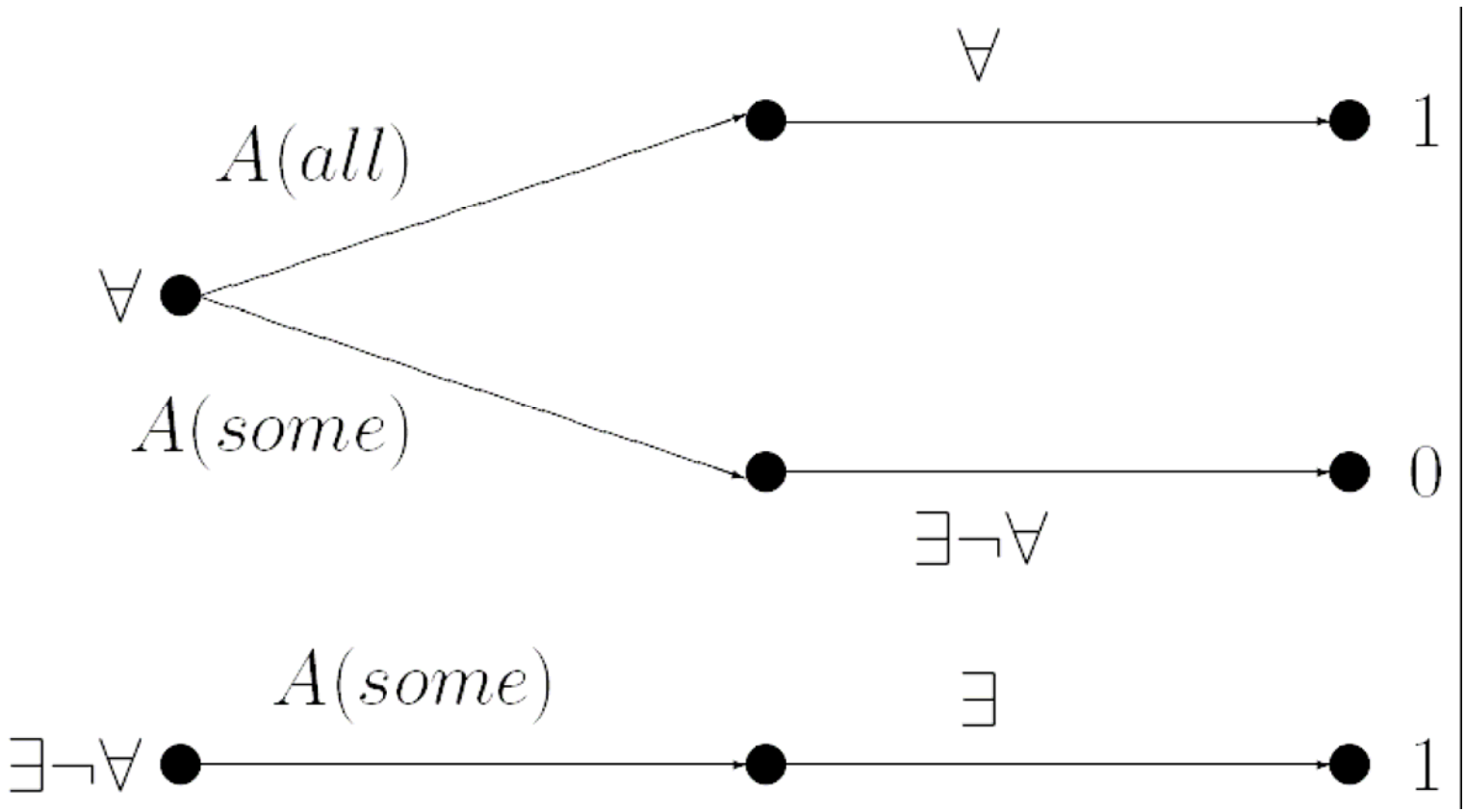
The situation were all of the boys came to the party:



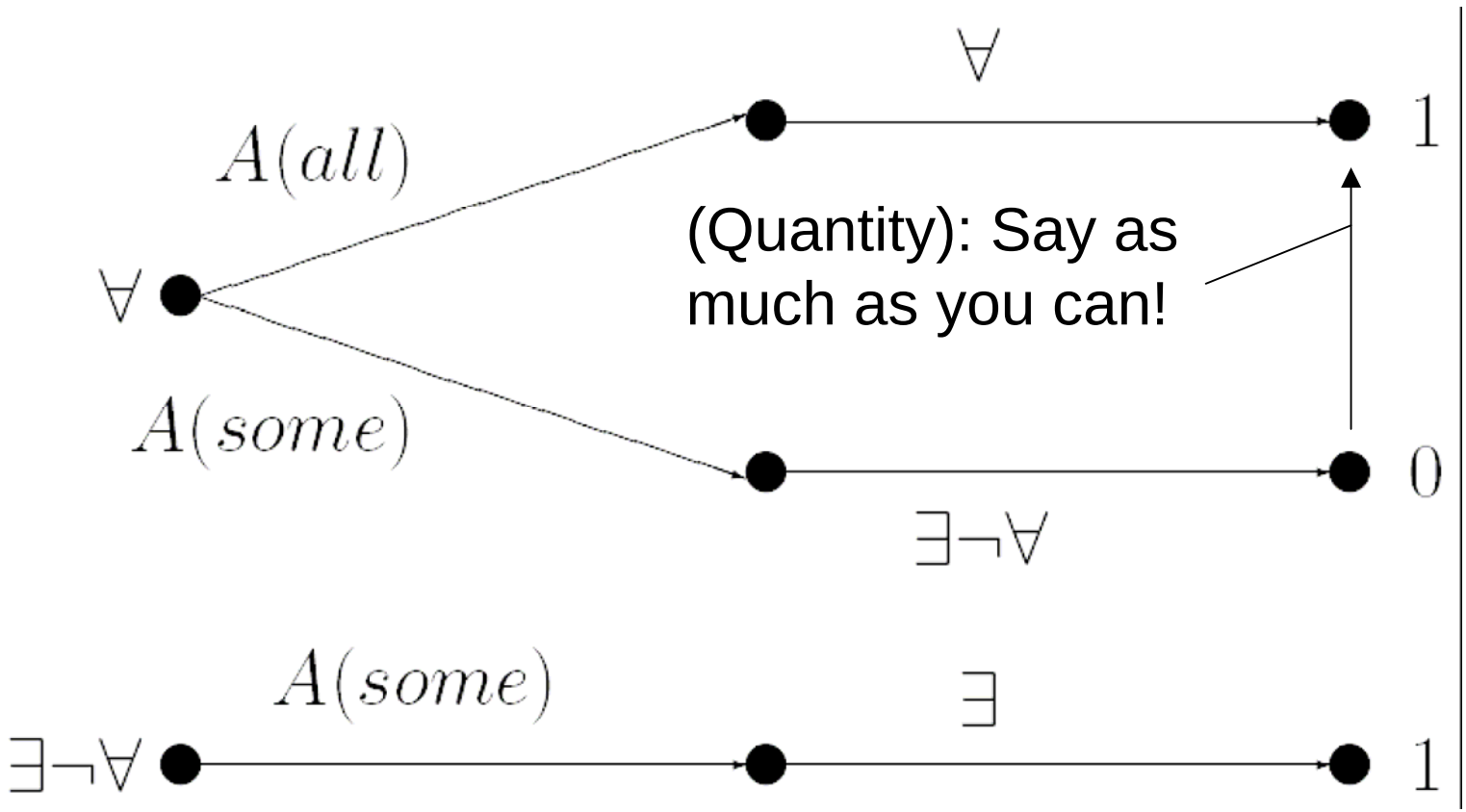
Taking into account the alternative situation where some but not all came:



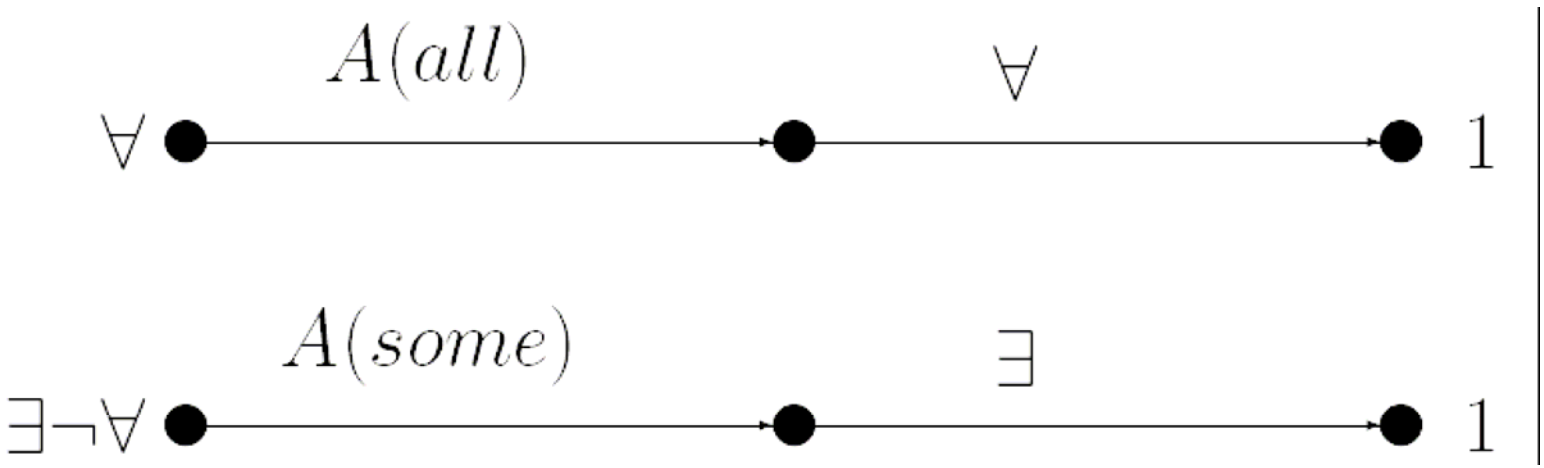
Adding speaker's preferences:



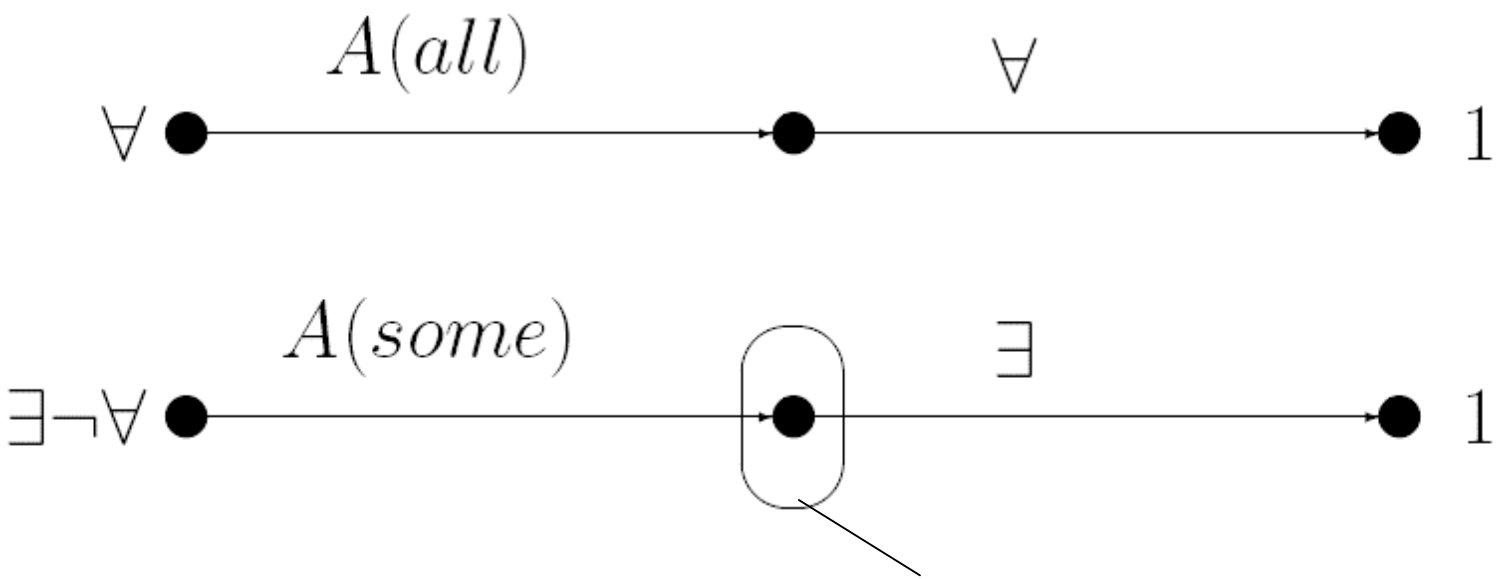
Adding speaker's preferences:



Hence, the speaker will choose:



Hence, the hearer can infer after receiving A(some) that:



Game and Decision Theory

Game Theory

"A game is being played by a group of individuals whenever the fate of an individual in the group depends not only on his own actions but also on the actions of the rest of the group." (Binmore, 1990)

Game Theory and Pragmatics

In a very general sense we can say that we play a game together with other people whenever we have to decide between several actions such that the decision depends on:

- the choice of actions by others
- our preferences over the ultimate results.

Whether or not an utterance is successful depends on

- how it is taken up by its addressee
- the overall purpose of the current conversation.

Decision Theory

If a decision depends only on

- the state of the world,
- the actions to choose from and
- their outcomes

but not on

- the choice of actions by other agents,

then the problem belongs to decision theory.

Remark

The situation depicted in the graph for scalar implicatures is a problem for decision theory!

- **Decision theory:** decisions of individual agents
- **Game theory:** interdependent decisions of several agents.

Why a New Framework?

- Basic concepts of Gricean pragmatics are undefined, most notably the concept of relevance.
- On a purely intuitive level, it is often not possible to decide whether an inference of an implicatures is correct or not.

An Example

A stands in front of his obviously immobilised car.

A: I am out of petrol.

B: There is a garage around the corner. (G)

+> The garage is open (H)

A “standard” explanation

Set H*:= The negation of H

- B said that G but not that H*.
- H* is relevant and $G \wedge H^* \Rightarrow G$.
- Hence if $G \wedge H^*$, then B should have said $G \wedge H^*$ (Quantity).
- Hence H* cannot be true, and therefore H.

A Second Explanation

1. B said that G but not that H.
2. H is relevant and $G \wedge H \Rightarrow G$.
3. Hence if $G \wedge H$, then B should have said $G \wedge H$ (Quantity).
4. Hence H cannot be true, and therefore H*.

Problem: We can exchange H and H* and still get a *valid* inference.

Without clarification of its basic concepts, the theory of conversational implicatures lacks true predictive power.

Lewis on Conventions (1969)

Lewis on Conventions

- **Lewis Goal:** Explain the conventionality of language meaning.
- **Method:** Meaning is defined as a property of certain solutions to signalling games.
- **Achievement:** Ultimately a reduction of meaning to a regularity in behaviour.

Lewis on Conventions

1. Some Examples of Conventions
2. Lewis' Definition of Convention
3. Signalling Games and Conventions
4. Meaning in Signalling Games

Examples of Conventions

Examples of Conventions I

Driving Left or Right

- All drivers have an interest to avoid crashes.
- If two drivers meet driving in opposite directions, then they have to agree who drives on which side of the street.
- In each region or country developed a convention which tells the drivers which side to choose.

Driving Left or Right

	Left	Right
Left	1, 1	0, 0
Right	0, 0	1, 1

Examples of Conventions II

Hume's boat rowers

Suppose that there are two rowers in a boat.

- Both have an interest to let the boat float smoothly and in straight direction.
- This they can only achieve if they row with the same rate.
- Hence, the rowers will constantly adjust their rates such that they meet the rate of their partner.

Hume's boat rowers

	r_1	r_2	r_3	r_4	$\ldots$
r_1	$1,1$	$0,0$	$0,0$	$0,0$	$\ldots$
r_2	$0,0$	$1,1$	$0,0$	$0,0$	$\ldots$
r_3	$0,0$	$0,0$	$1,1$	$0,0$	$\ldots$
r_4	$0,0$	$0,0$	$0,0$	$1,1$	$\ldots$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$

Examples of Conventions III

Rousseau's stag hunters

There is a party of hunters.

- They have the possibility to hunt stag together or hunt rabbit individually.
  - If they hunt stag together, they are provided with meat for several days.
  - If they hunt individually, then they can only hunt rabbit which provides them with meet for only one day.
- They have only success hunting stag if everybody joins in. $\Rightarrow$ If one hunter drops out, then all others who still go for stag will achieve nothing.

Rousseau’s stag hunters

	Stag	Rabbit
Stag	2, 2	0, 1
Rabbit	1, 0	1, 1

Examples of Conventions IV

Lewis' fire collectors

There is a party of campers looking for fire wood.

- It does not matter to anyone which area he searches but
- everyone has an interest not to search the same place which has already been searched by another member of the party.

Lewis’ fire collectors

	North	South
North	0, 0	1, 1
South	1, 1	0, 0

Lewis' Definition of Convention

(Lewis, 2002, p. 58)

A regularity R in the behaviour of members of a population P when they are agents in an recurrent situation S is a convention if and only if it is true that, and is common knowledge in P that, in any instance of S among member of P,

1. everyone conforms to R;
2. everyone expects everyone else to conform to R;
3. everyone prefers to conform to R under the condition that the others do, since S is a coordination problem and uniform conformity to R is a coordination equilibrium in S.

Analysis of Conventions

- Conventions are solutions to a **coordination problem**.
- The coordination problem is a **recurrent** coordination problem.
- A convention consists in a **regularity in behaviour**.

- Everyone **expects** the others to follow the convention.
- A true convention has to be an **arbitrary** solution to the coordination problem.

- *In order to count as a true convention, it must be in everybody's interest that everybody follows the convention.*

Representations of Regularities of Behaviour

A regularity in behaviour can be represented by an agent's **strategy**:

- A function that tells for each type of situation which action the agent will perform.

$$S : \text{Situation-type} \rightarrow \text{Actions}$$

Signalling Conventions

(preliminary – simple cases)

The Coordination Problem in Communication

- The speaker wants to communicate some meaning M.
- In order to communicate this he chooses a **form** F.
- The hearer interprets the form F by choosing a **meaning** M'.
- Communication is successful if M=M'.

The Signalling Game

- Let $\mathcal{F}$ be a set of forms and $\mathcal{M}$ a set of meanings.
- The speaker's signalling strategy is a function

$$S : \mathcal{M} \rightarrow \mathcal{F}$$

- The hearer's interpretation strategy is a function

$$H : \mathcal{F} \rightarrow \mathcal{M}$$

- Speaker and hearer have success if always

$$S(M) = F \Rightarrow H(F) = M$$

Lewis' Signalling Convention

- A solution to the signalling game is a strategy pair (S,H).
- A strategy pair (S,H) with

$$S : \mathcal{M} \to \mathcal{F} \text{ and } H : \mathcal{F} \to \mathcal{M}$$

is a **signalling convention** if

$$H \circ S = id|_{\mathcal{M}}$$

Meaning in Signalling Games

Meaning in Signalling Conventions

Lewis (IV.4,1996) distinguishes between

- indicative signals
- imperative signals

Two different definitions of **meaning**:

- **Indicative:**

  A form F signals that M if S(M)=F

- **Imperative:**

  A form F signals to interpret it as H(F)

- Two possibilities to define meaning.
- Coincide for signalling conventions in simple signalling games.
- Lewis **defines** truth conditions of signals F as $S^{-1}(F)$.

The Paul Revere Examples

A scene from the American War of independence:

The sexton of the Old North Church informs Paul Revere about the movements of the British troops, the redcoats. The only possibility to communicate with each other is by use of lanterns. A possible signalling strategy of the sexton may look as follows:

A Possible Signalling Strategy

1. If the redcoats are observed staying home, hang no lantern in the belfry;
2. If the redcoats are observed setting out by land, hang one lantern in the belfry;
3. If the redcoats are observed setting out by sea, hang two lanterns in the belfry.

An Interpretation Strategy

1. If no lantern is observed hanging in the belfry, go home;
2. If one lantern is observed hanging in the belfry, warn the countryside that the redcoats are coming by land;
3. If two lanterns are observed hanging in the belfry, warn the countryside that the redcoats are coming by sea.

Representation of strategies

	stay	land	sea	*states*
S	0	1	2	*lanterns*

	0	1	2	*lanterns*
H	stay	land	sea	*states*

- The strategy pair is obviously a signalling convention.
- It solves the coordination problem.
- It is arbitrary.

Meaning of the Signals

Given the signalling convention before:

- 0 lanterns in the belfry *means* that the British are staying home.
- 1 lantern in the belfry *means* that the British are setting out by land.
- 2 lantern in the belfry *means* that the British are setting out by sea.

Some Remarks about the General Perspective

- **Assumption:** speaker and hearer use language according to a given semantic convention.
- **Goal:** Explain how implicatures can emerge out of semantic language use.

- Non-reductionist perspective with respect to semantic meaning.
- Reductionist perspective with respect to implicated meaning

Implicated meaning is in general not part of conventional meaning:

- A stands in front of his obviously immobilised car.

  A: I am out of petrol.

  B: There is a garage around the corner.

+> The garage is open

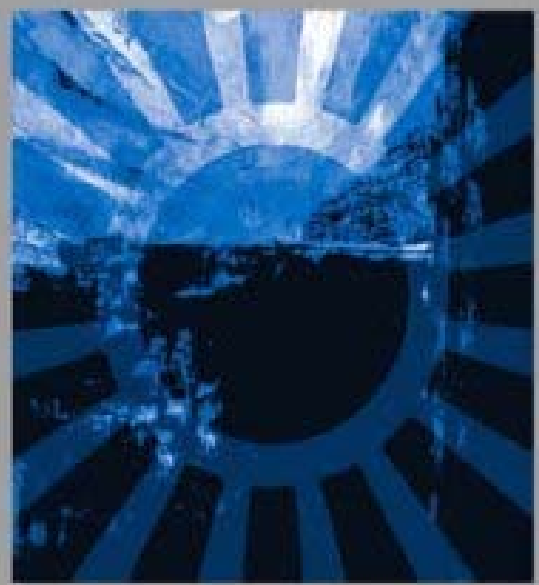
PCIs and GCIs

- The goal is a foundational one.
- All implicatures will be treated as particularised conversational implicatures (PCIs).
- We will not discuss generalised conversational implicatures (GCIs) or Grice' conventional implicatures.

The Agenda

Putting Grice on Lewisean feet!

Edited by
Anton Benz, Gerhard Jäger
and Robert van Rooij



Game Theory and Pragmatics

Palgrave Studies in Pragmatics, Language and Cognition