

Conditionals, Inference, and Evidentiality

Karolina Krzyżanowska
Sylvia Wenmackers
Igor Douven
Sara Verbrugge

Logic & Cognition Workshop
ESSLI 2012

Outline

- 1 Introduction
 - Conditionals
 - Inference
 - Evidentiality
- 2 Experiments
 - Motivation
 - Method
 - Results
- 3 Discussion

CONDITIONALS

Conditionals

What's wrong with them?

Conditionals

What's wrong with them?

- (1) If badgers are cute, then $4+7=11$.
- (2) If $23+45=8$, then the world will end next year.
- (3) If dogs are people's best friends, then they have four legs.

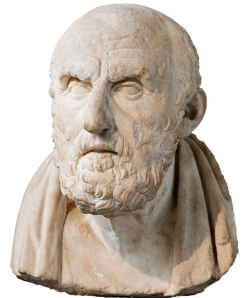
What links a conditional's antecedent and its consequent?

What links a conditional's antecedent and its consequent?

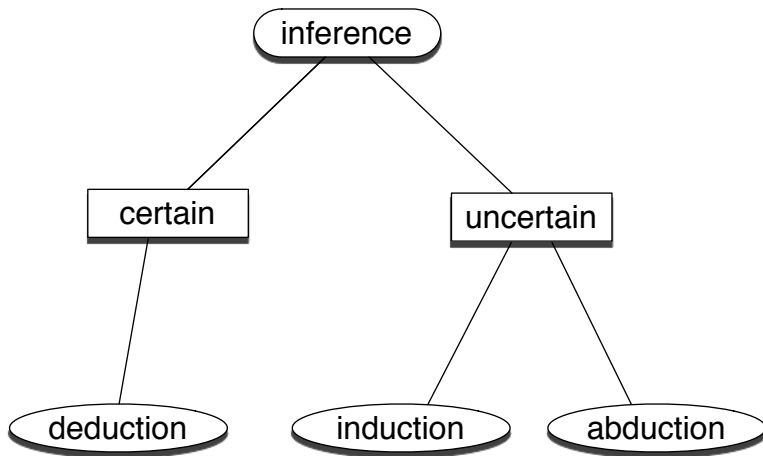
- an inference from a conditional's antecedent to its consequent.
- conditionals as “condensed arguments” (Woods 2003).

An old philosophical idea

A conditional is true if and only if it corresponds to a valid argument (Chrysippus).



INFERENCE



Classifying conditionals

Classifying conditionals

- subjunctive vs. indicative conditionals

Classifying conditionals

- subjunctive vs. indicative conditionals
- content vs. inferential conditionals

Classifying conditionals

- subjunctive vs. indicative conditionals
- content vs. **inferential conditionals**

A new typology of inferential conditionals

A new typology of inferential conditionals

- certain:
 - deductive inferential conditionals
- uncertain:
 - inductive inferential conditionals
 - abductive inferential conditionals

Igor Douven and Sara Verbrugge (2010), The Adams family. *Cognition* 117, 302–318.

Inferential conditionals

Definition

A sentence “If p , then q ” is a deductive inferential (DI) / inductive inferential (II) / abductive inferential (AI) conditional iff q is a deductive / inductive / abductive consequence of p .

Inferential conditionals

Definition

A sentence “If p , then q ” is a deductive inferential (DI) / inductive inferential (II) / abductive inferential (AI) conditional iff q is a deductive / inductive / abductive consequence of p .

Definition

A sentence “If p , then q ” is a contextual DI / II / AI conditional iff q is a deductive / inductive / abductive consequence of $\{p, p_1, \dots, p_n\}$, with p_1, \dots, p_n being background premises salient in the context in which $p \rightarrow q$ is asserted or being evaluated.

Examples of DI conditionals

- (4) If all Indian elephants have small ears and Babou is an Indian elephant, then Babou has small ears.

Examples of DI conditionals

(4) If all Indian elephants have small ears and Babou is an Indian elephant, then Babou has small ears.

CONTEXT: All Indian elephants have small ears.

(5) If Babou is an Indian elephant, then it has small ears.

Examples of II conditionals

(6) If 95% of students pass this exam, you will pass as well.

Examples of II conditionals

(8) If 95% of students pass this exam, you will pass as well.

CONTEXT: Bernard is a bit of an irregular student: sometimes he works hard, but he can also be lazy. So far he had excellent grades for most courses for which he had worked hard.

(9) If Bernard works hard for the linguistics course, then he will get an excellent grade for it.

Examples of AI conditionals

(7) If David is coughing and sneezing, then he caught an infection.

Examples of AI conditionals

(7) If David is coughing and sneezing, then he caught an infection.

CONTEXT: Nelly lives on the sixth floor of an apartment building. The elevator has been broken since earlier this morning. A good friend of Nelly's who lives on the third floor of the same building hears someone rushing down the stairs. She knows that Nelly tends to avoid exercise as much as possible.

(8) If that's Nelly rushing down the stairs, then she is in a hurry.

EVIDENTIALITY

Evidentiality

- Monitoring source and quality of the evidence

Evidentiality

- Monitoring source and quality of the evidence
- Various markers of evidentiality:

Evidentiality

- Monitoring source and quality of the evidence
- Various markers of evidentiality:
 - grammatically encoded (prefixes, suffixes, etc.)

Evidentiality

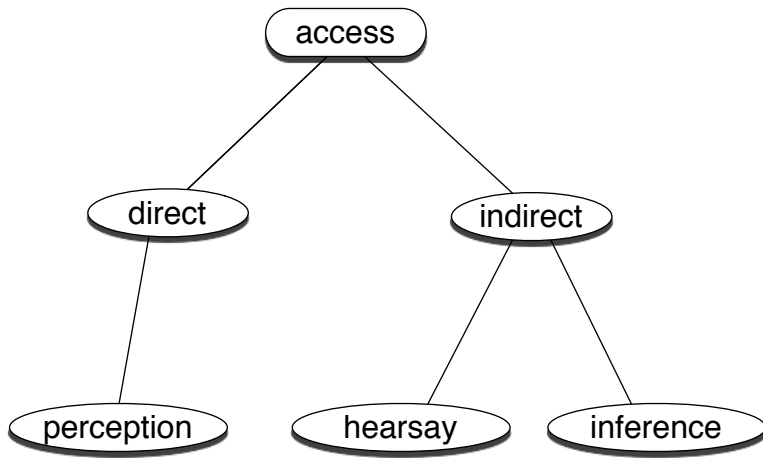
- Monitoring source and quality of the evidence
- Various markers of evidentiality:
 - grammatically encoded (prefixes, suffixes, etc.)
 - lexical markers (“I saw”, “I heard”, “allegedly” etc.)

Evidentiality

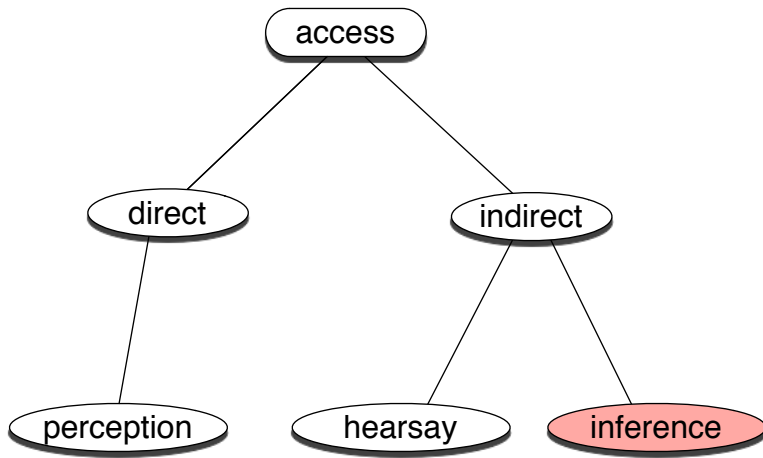
- Monitoring source and quality of the evidence
- Various markers of evidentiality:
 - grammatically encoded (prefixes, suffixes, etc.)
 - lexical markers (“I saw”, “I heard”, “allegedly” etc.)
- Willett’s categorisation.

Thomas Willett (1988), A cross-linguistic survey of the grammaticization of evidentiality. *Studies in Language* 12(1), 51–97.

Basic categories of evidentiality (Willetts 1988)



Basic categories of evidentiality (Willetts 1988)



Candidates for inferential markers

“MUST”

and

“SHOULD”

Kai von Fintel and Anthony Gillies (2007), An Opinionated Guide to Epistemic Modality. *Oxford Studies in Epistemology* 2, 32-63.

Markers of inference

(9) a. Susan studied philosophy. She **should** know who Hegel was.

Markers of inference

- (9) a. Susan studied philosophy. She **should** know who Hegel was.
b. ? Susan just published a book on Hegel. She **should** know who Hegel was.

Markers of inference

- (9) a. Susan studied philosophy. She **should** know who Hegel was.
b. ? Susan just published a book on Hegel. She **should** know who Hegel was.
- (10) a. I heard Jim got a post-doc position. He **must** have already defended his PhD.

Markers of inference

- (9) a. Susan studied philosophy. She **should** know who Hegel was.
b. ? Susan just published a book on Hegel. She **should** know who Hegel was.
- (10) a. I heard Jim got a post-doc position. He **must** have already defended his PhD.
b. ? I attended Jim's public PhD defence last month. He **must** have already defended his PhD.

Markers of inference

- (9) a. Susan studied philosophy. She **should** know who Hegel was.
b. ? Susan just published a book on Hegel. She **should** know who Hegel was.
- (10) a. I heard Jim got a post-doc position. He **must** have already defended his PhD.
b. ? I attended Jim's public PhD defence last month. He **must** have already defended his PhD.
- (11) a. The key is either in my pocket or in the bag. It is not in my pocket, so it **must** be in the bag.

Markers of inference

- (9) a. Susan studied philosophy. She **should** know who Hegel was.
b. ? Susan just published a book on Hegel. She **should** know who Hegel was.
- (10) a. I heard Jim got a post-doc position. He **must** have already defended his PhD.
b. ? I attended Jim's public PhD defence last month. He **must** have already defended his PhD.
- (11) a. The key is either in my pocket or in the bag. It is not in my pocket, so it **must** be in the bag.
b. ? I see that the key is in the bag, so it **must** be in the bag.

- 1 Are “must” and “should” really inferential markers?

- ① Are “must” and “should” really inferential markers?
- ② Do they mark any inference?

- ① Are “must” and “should” really inferential markers?
- ② Do they mark any inference?
- ③ Can they serve as “litmus papers”?

THE EXPERIMENT

Questions

- 1 How does adding an evidential marker to an inferential conditional's consequent affect its assertability?

Questions

- 1 How does adding an evidential marker to an inferential conditional's consequent affect its assertability?
- 2 Is the pattern common for different languages?

Method

- three versions of the survey: English ($N = 95$), Dutch ($N = 47$) and Polish ($N = 42$)
- all participants were native speakers.
- the type of conditional (DI / II / AI) as well as lexical markers were manipulated within subjects.
- each participant were presented with 15 contexts: 5 involved deductive inference, 5 involved inductive inference, and 5 involved abductive inference.
- each context was followed by 3 conditional sentences: one without any marker, one with “should” / “powinien” / “zal wel”, and one with “must” / “musi” / “moet wel”.
- 7-point scale of assertability.

Example stimulus: deductive inference

Context: All Indian elephants have small ears.

How assertable are the following conditionals given this context?

If Babou is an Indian elephant, then it has small ears.

If Babou is an Indian elephant, then it should have small ears.

If Babou is an Indian elephant, then it must have small ears.

Example stimulus: inductive inference

Context: Bernard is a bit of an irregular student: sometimes he works hard, but he can also be lazy. So far he had excellent grades for most courses for which he had worked hard.

How assertable are the following conditionals given this context?

If Bernard works hard for the linguistics course, then he will get an excellent grade for it.

If Bernard works hard for the linguistics course, then he should get an excellent grade for it.

If Bernard works hard for the linguistics course, then he must get an excellent grade for it.

Example stimulus: abductive inference

Context: Nelly lives on the sixth floor of an apartment building. The elevator has been broken since earlier this morning. A good friend of Nelly's who lives on the third floor of the same building hears someone rushing down the stairs. She knows that Nelly tends to avoid exercise as much as possible.

How assertable are the following conditionals given this context?

If that's Nelly rushing down the stairs, then she is in a hurry.

If that's Nelly rushing down the stairs, then she should be in a hurry.

If that's Nelly rushing down the stairs, then she must be in a hurry.

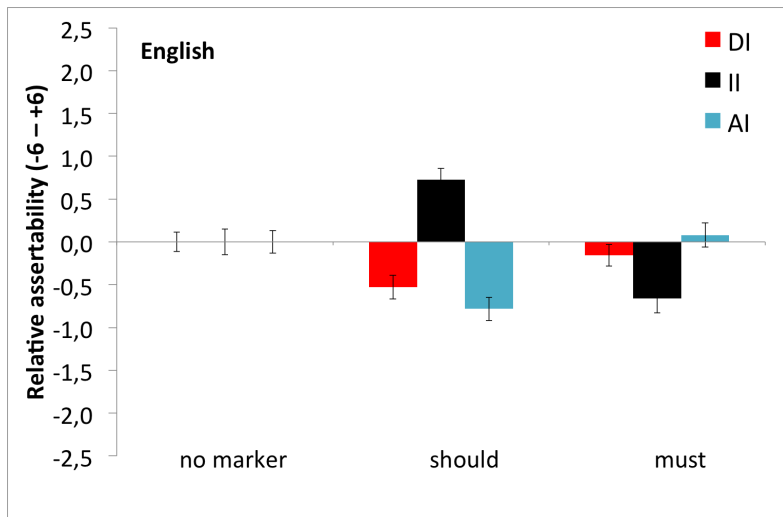
RESULTS

What did we measure?

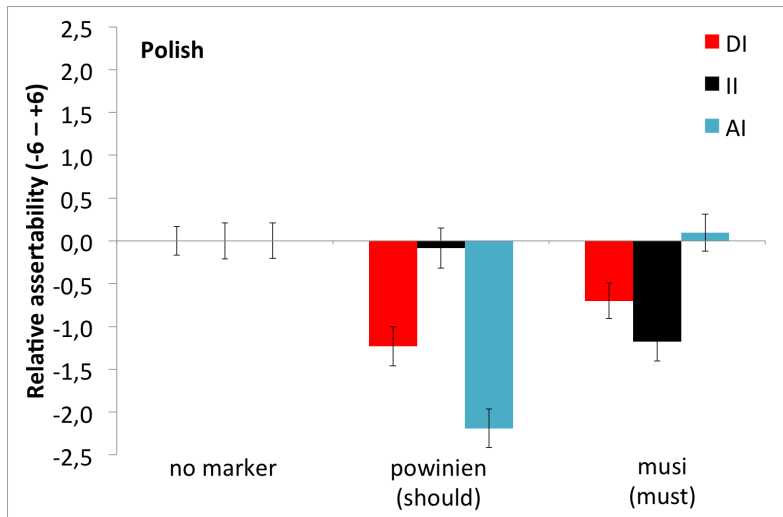
RELATIVE ASSERTABILITY

= assertability with a marker MINUS assertability without a marker.

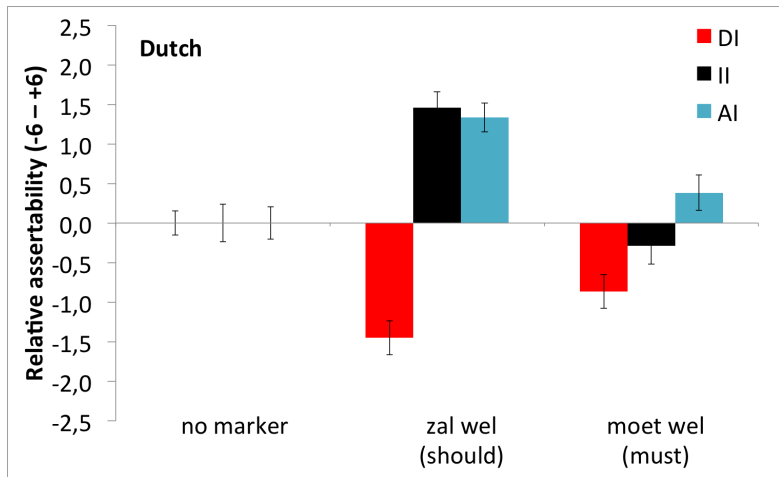
Results: English linguistic markers



Results: Polish linguistic markers



Results: Dutch linguistic markers



- ① English “must” and “should” are inferential markers.
 - “should” is a marker of inductive inference.
 - “must” is a marker of abductive inference.
- ② Polish “musi” is a marker of abductive inference.
- ③ The role of Polish “powinien” is unclear.

- ① English “must” and “should” are inferential markers.
 - “should” is a marker of inductive inference.
 - “must” is a marker of abductive inference.
- ② Polish “musi” is a marker of abductive inference.
- ③ The role of Polish “powinien” is unclear.
- ④ Dutch “moet wel” is a marker of abductive inference.
- ⑤ Dutch “zal wel” seems to mark only uncertainty.

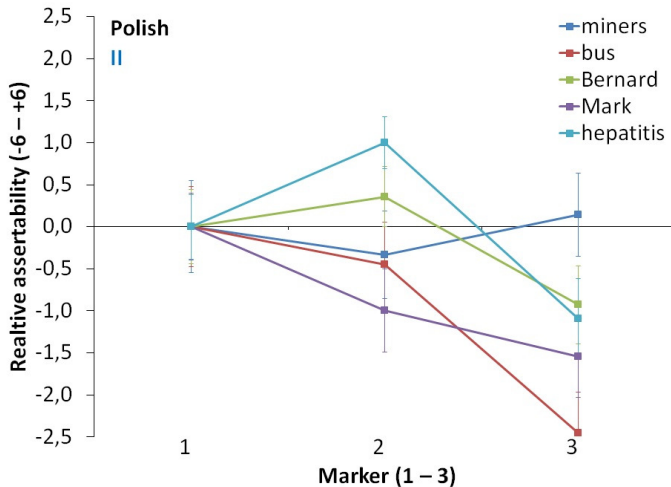
- ① English “must” and “should” are inferential markers.
 - “should” is a marker of inductive inference.
 - “must” is a marker of abductive inference.
- ② Polish “musi” is a marker of abductive inference.
- ③ The role of Polish “powinien” is unclear.
- ④ Dutch “moet wel” is a marker of abductive inference.
- ⑤ Dutch “zal wel” seems to mark only uncertainty.
- ⑥ Additional support for the claim that the typology of conditionals proposed by Douven and Verbrugge (2010) is of theoretical significance.

DISCUSSION

Polish “powinien” vs. English “should”

- In Polish, a normative interpretation of the modal verb “powinien” (“should”) seems to be more salient than in English or in Dutch.

Polish “powinien” vs. English “should”



Polish “powinien” vs. English “should”

Context: A pharmaceutical company unexpectedly got into financial trouble. They had to cut many jobs and decided to fire almost all employees above 50. Mark is an employee of this company.

How assertable are the following conditionals given this context?

If Mark is above 50, then he should be among the employees who will be fired.

Example stimulus: inductive inference

Context: Bernard is a bit of an irregular student: sometimes he works hard, but he can also be lazy. So far he had excellent grades for most courses for which he had worked hard.

How assertable are the following conditionals given this context?

If Bernard works hard for the linguistics course, then he should get an excellent grade for it.

Thank you!