

# **Abductive Conditionals as a Test Case for Inferentialism**

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**If the UK is a monarchy, then cats are felines.**

- How to explain the strangeness of missing-link conditionals?

1.

# Inferentialism

An inferential semantics of  
conditionals



**A conditional is true iff there is a strong enough argument from antecedent to consequent, given background knowledge.**

- Proposed by Krzyżanowska, Wenmackers and Douven (2014).
- Compelling argument can include deductive steps and ampliative steps: inductive and abductive inferences.
- Does not validate Centering.



# **(1) Truth of a conditional**

- Strength of inferential connection between antecedent and consequent predicts endorsement rate of conditional being true.



# (1) Truth of a conditional

- *Strength of inferential connection between antecedent and consequent predicts endorsement rate of conditional being true.*
- Alternatively: truth of a conditional is predicted by the number of available alternative models in which the conditional is not true.



## **(2) Modus Ponens arguments**

- Strength of inferential connection between antecedent and consequent of the major premise in MP predicts rate of endorsement of the conclusion, keeping confidence in minor premise fixed.



## (2) Modus Ponens arguments

- *Strength of inferential connection between antecedent and consequent of the major premise in MP predicts rate of endorsement of the conclusion, keeping confidence in minor premise fixed.*
- Alternatively, suppositional account: rate of endorsement of the conclusion is predicted by probability of the conditional, as given by the Equation:  
$$P(\text{If } p, \text{ then } q) = P(q|p).$$





# Conditionals as “leaky pipes”

# 2.

## **Abductive conditionals**

Inferential strength is determined by  
explanation quality



# Hypotheses

**H1. Explanation quality of the consequent, given antecedent as explanandum, predicts endorsement rate of conditional being true.**

=> Compare with: number of retrieved counter-examples predicts endorsement (Cummins et al, 1991; De Neys et al, 2003).

**H2. Explanation quality of the consequent, given antecedent as explanandum, predicts endorsement rate of conclusion of MP being true.**

=> Compare with: probability of the conditional (as defined by the Equation) predicts endorsement.



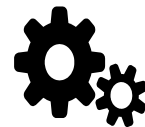
# Materials

**If John did well on his exam, then he studied hard.**

**If the water is boiling, then it was heated to 100°C.**

- 16 abductive conditionals referring to everyday situations of the form “If EVENT, then EXPLANATION.”
- Adapted from causal conditionals developed by Cummins, Lubart, Alksnis & Rist (1991) and by de Neys, Schaeken & d’Ydewalle (2003).

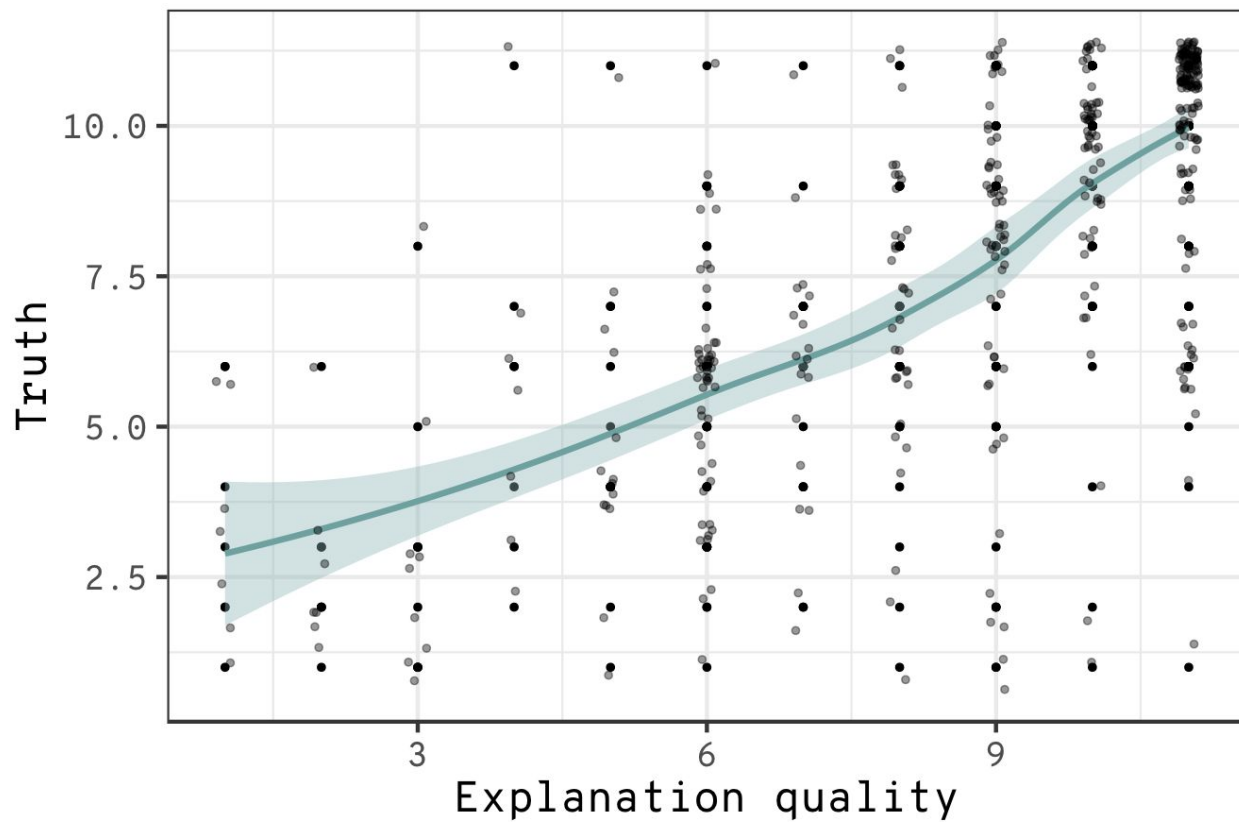
# Experiment 1: truth of a conditional



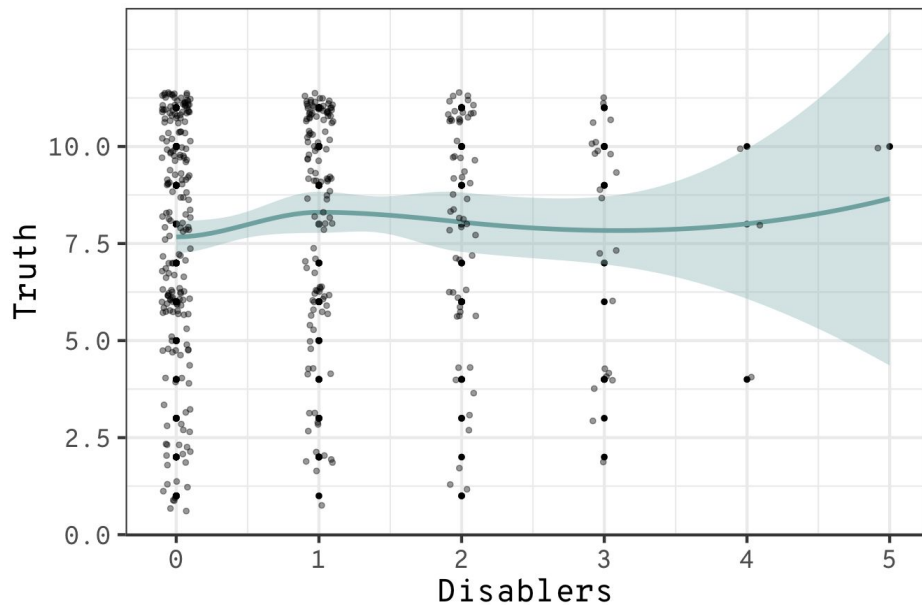
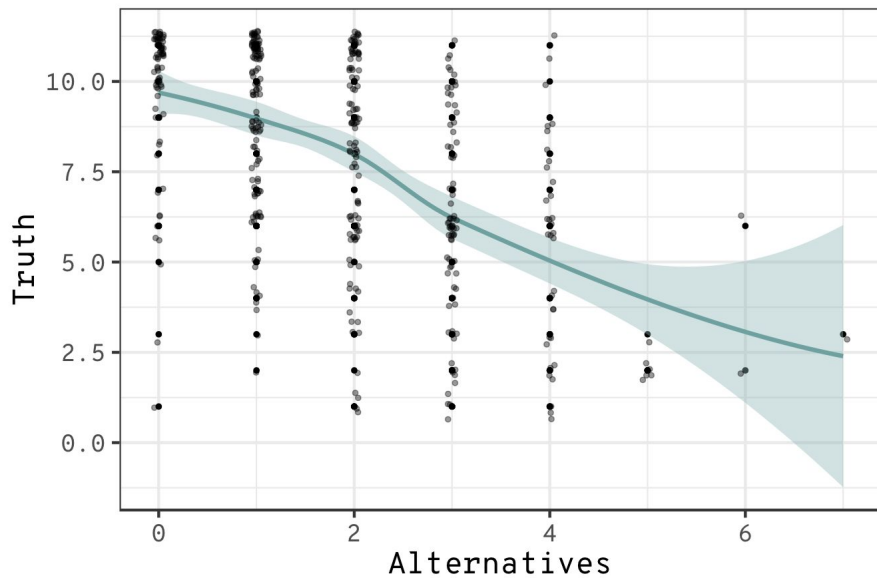
- ‘Suppose we observe that  $\phi$ . We propose to explain this by  $\psi$ . How would you rate the quality of this explanation?’ [11-point Likert scale]
- ‘How strongly do you agree that this statement is true?’ [11-point Likert scale]



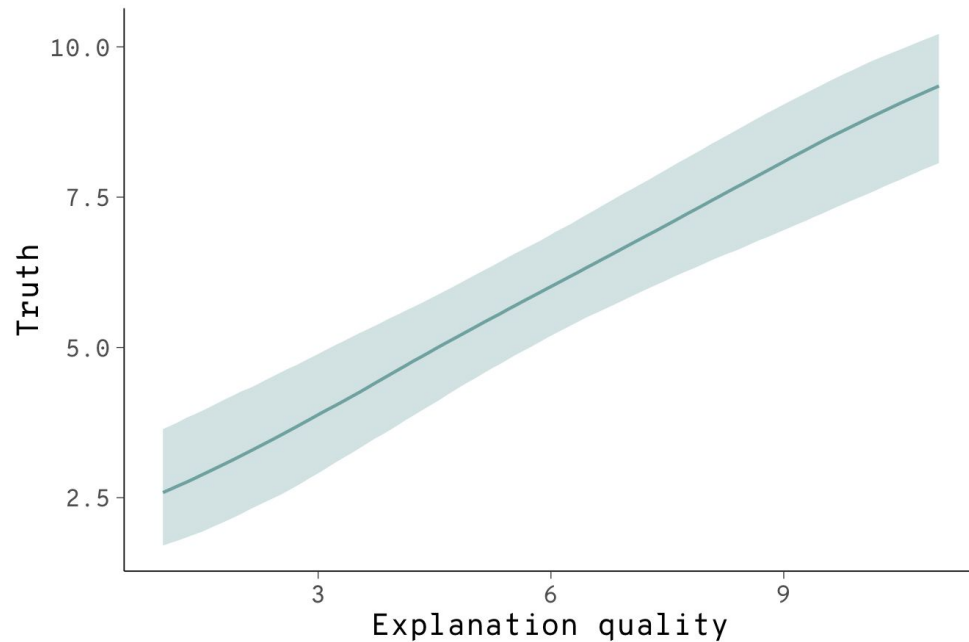
- ‘Can you find other possible explanations for this fact?’ [60s per item]
- ‘Can you find examples of events that could have prevented the explanation from producing this fact?’ [60s per item]



**Truth and quality judgments** (*exploratory plots,  $n = 27$ , ♀ : 19*)



**Truth and # of generated counter-examples** (*exploratory plots,  $n = 27$ , ♀: 19*)



- ← **Marginal effects for best Bayesian ordinal regression model** (95% CI)
- ↓ **Comparison table of CLMMs** (Q: quality, A: alternatives, D: disablers).

predictor(s)	<i>k</i>	LL	AIC	$\Delta$ AIC	BIC	$\Delta$ BIC
Q, A, D	33	-660.30	1386.60	13.47	1518.73	77.54
A, D	24	-733.12	1514.23	141.10	1610.33	169.13
Q	17	-669.56	1373.13	0.00	1441.19	0.00

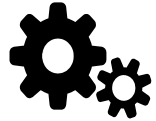


C1.



# TRUTH OF AN ABDUCTIVE CONDITIONAL

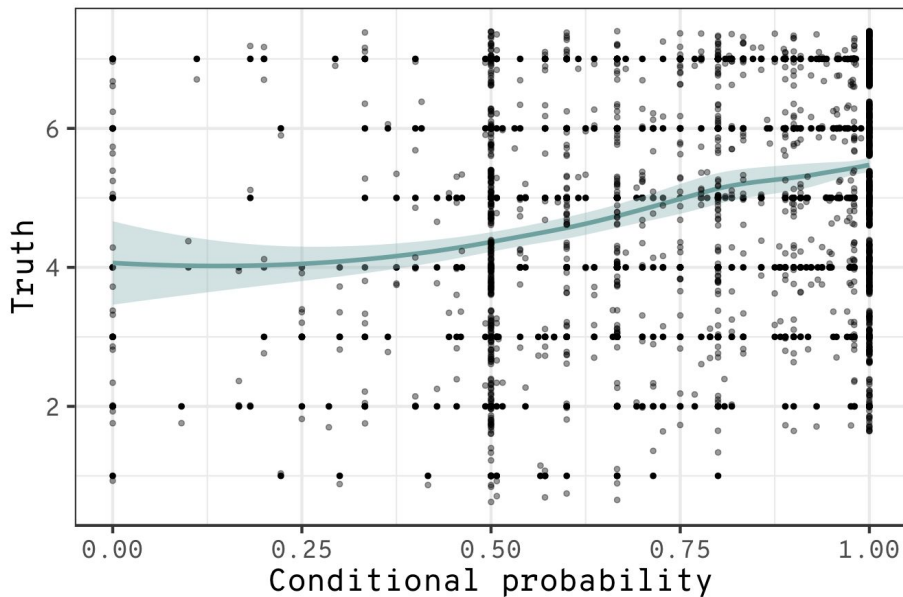
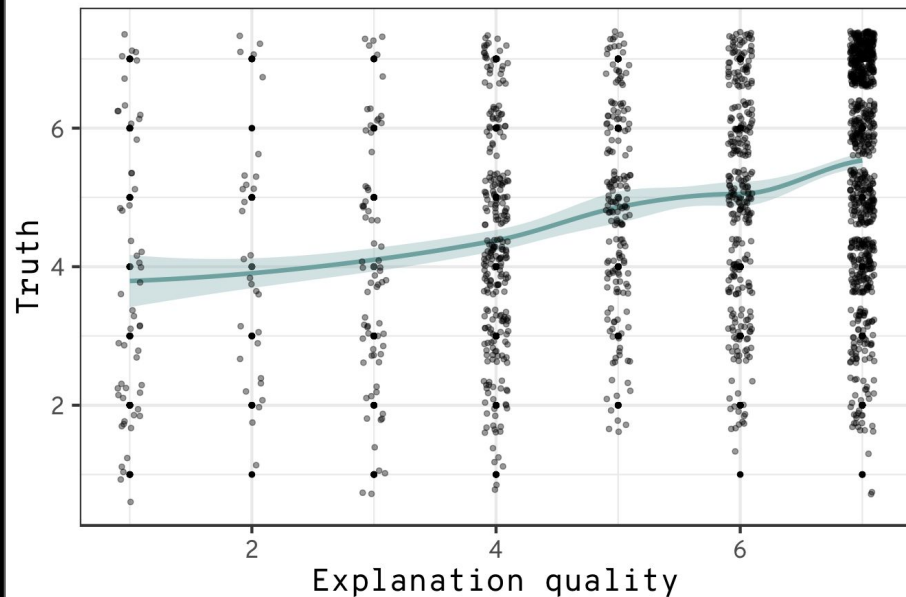
Strong support for Inferentialism.  
Explanation quality, which determines  
inferential strength, is the best predictor of  
rate of endorsement of a conditional.



# Experiment 2: MP arguments

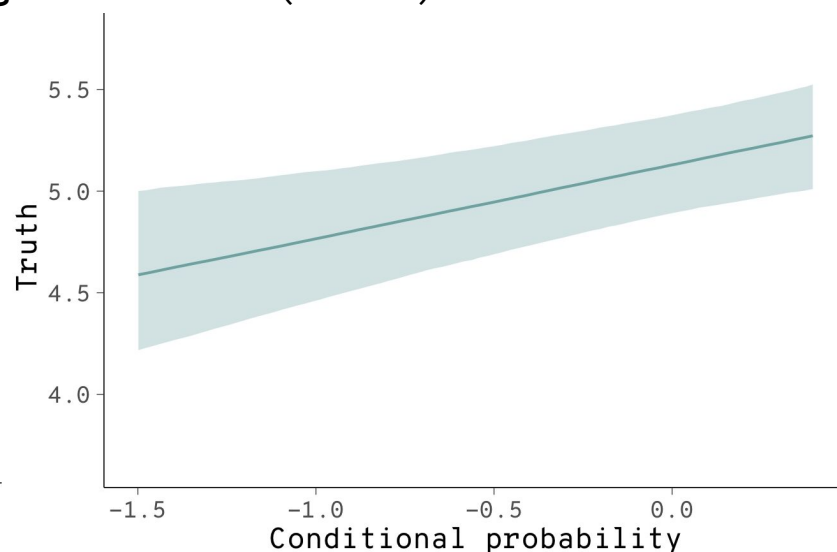
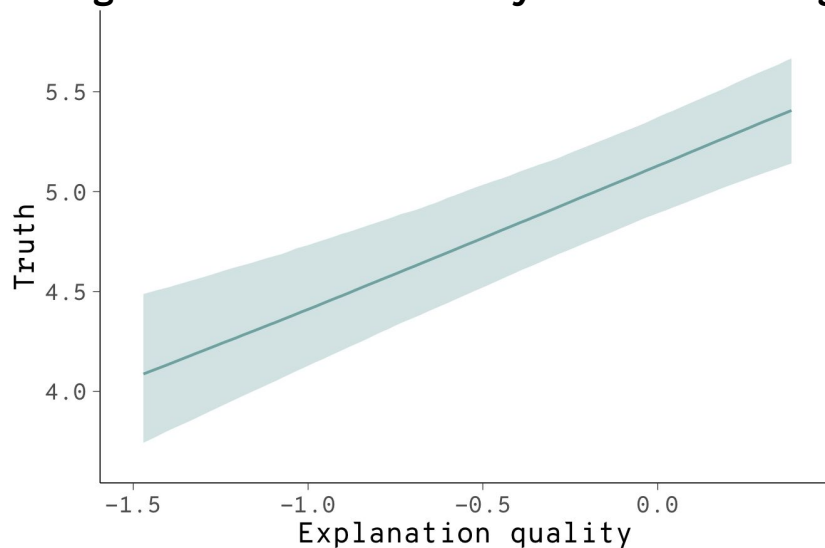


- ‘How would you rate the quality of this explanation?’ [7-point Likert scale]
- Minor premise: Dennis tells you that  $\phi$ . [4 witnesses with 100, 75, 50, 25% reliability]  
Major premise: Now suppose that if  $\phi$ , then  $\psi$ .  
How strongly do you agree that it is true that  $\psi$ ? [7-point Likert scale]
- Rate four situations:  $\phi$  &  $\psi$ ,  $\phi$  &  $\neg\psi$ ,  $\neg\phi$  &  $\psi$ ,  $\neg\phi$  &  $\neg\psi$ . [Must sum to 100%; used to compute conditional probability]



**Truth vs quality judgments; truth vs conditional probability**  
(*exploratory plots,  $n = 120$ , ♀:70*)

## Marginal effects for full Bayesian ordinal regression model (95% CI)



## Comparison table of CLMMs

(WR: witness reliability, EQ: explanatory quality, CP: conditional probability)

predictors	$k$	LL	AIC	$\Delta$ AIC	BIC	$\Delta$ BIC
WR, EQ, CP	11	-2445.96	4913.92	0.00	4973.71	0.00
WR, EQ	10	-2453.97	4927.93	14.01	4982.29	8.58
WR, CP	10	-2481.31	4982.62	68.70	5036.98	63.26



# MODUS PONENS ARGUMENTS

Again, strong support for Inferentialism.  
Explanation quality, which determines  
inferential strength of the major premise of  
an MP, is a stronger predictor of rate of  
endorsement of the conclusion.

# PUTTING INFERENTIALISM



## TO THE TEST

- Inferentialism: requires a compelling argument from antecedent to consequent, with a broad notion of inference.
- Using realistic abductive conditionals, where the inferential connection is an explanatory relationship, found strong support for inferentialism.
- Inferential connection in abductive conditionals is highly predictive of truth of conditionals and of endorsement of MP conclusions.
- Note that probability still had predictive power.

# Thanks!

## Any questions?

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- [igor.douven@gmail.com](mailto:igor.douven@gmail.com)



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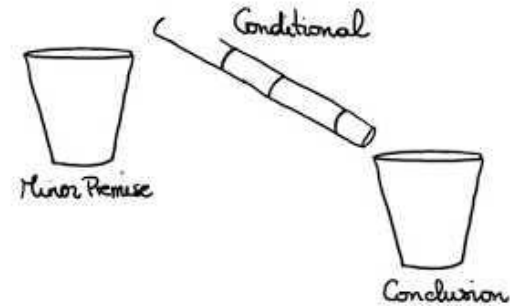
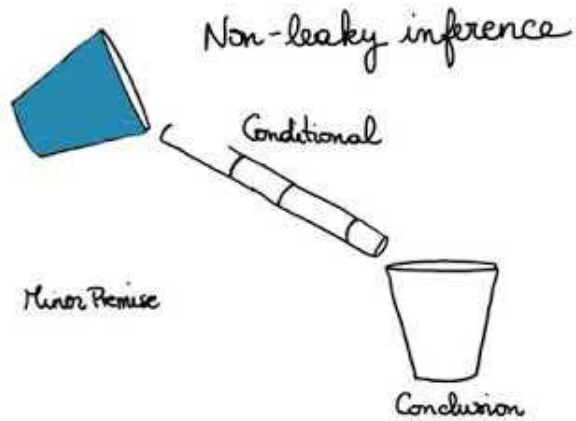
*The conditional “If p, then q” is an inference ticket which allows us to “travel” from p to q (which we may in fact never do).*

“

*Asserting “If p, then q” is like asserting “p, so q”, without committing oneself to the truth of either p or q.*

- RYLE, G. (1950). ‘If’, ‘So’, and ‘Because’.





# Conditionals as “leaky pipes”

— VOUTURE