Negation and alternatives in counterfactual antecedents

Dean McHugh
joint work with Alexandre Cremers

Inquisitive semantics seminar
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Institute of Logic, Language and Computation
University of Amsterdam

Alternatives in counterfactual antecedents

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Contemporary semantics of conditionals distinguish

1. the alternatives raised by a conditional antecedent
2. the mechanism used to hypothetically assume each alternative

(3) Ciardelli (2016): $A > C$ is true at a state s just in case for every $p \in \text{alt}(A)$ there is a $q \in \text{alt}(C)$ such that $s \subseteq p \Rrightarrow q$

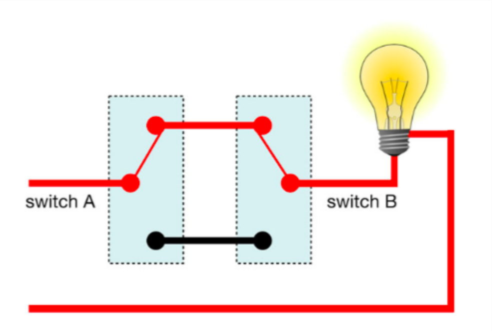
Recent work on conditional antecedents

Recent work on the semantics of conditionals

- Ciardelli et al. (2018) — inquisitive semantics
- Fine (2012) — truthmaker semantics
- Santorio (2018) — truthmaker/alternative semantics
- Willer (2018) — dynamic semantics
- Schulz (2018) — novel semantics of negation

Each paper has a different semantic entry for negation

Ciardelli et al. (2018)



(4) a. If switch A or switch B was down, the light would be off.

b. If switch A and switch B were not both up, the light would be off.

Contemporary semantics of conditionals

Willer (2018)

- Dynamic semantics for conditionals
- Validates De Morgan's law $\neg(A \wedge B) \equiv \neg A \vee \neg B$

We need to explain why [(4a)] and [(4b)] draw attention to different possibilities. One option is to revise the negative entry for conjunction. But another option is to keep the entry as it is and to explore the role of expressions like 'both' in generating alternatives over and above the ones predicted by the clause for negated conjunction. Further inquiry, including work at the empirical level, is needed to decide which of these options is more viable. *(Willer, 2018, 390)*

Schulz (2018)

(5) *Schulz negation (n-ary version)*

a. $\mathcal{L}(\varphi) = \{a : a \text{ is an atomic sentence appearing in } \varphi\}$

b. $w \sim_\varphi v$ iff $w(a) = v(a)$ for every $a \in \mathcal{L}(\varphi)$

c. For any information state $p \subseteq W$,

(i) $p \models Q(\varphi)$ iff $w \sim_\varphi v$ for every $w, v \in p$

(ii) $p \perp \varphi$ iff $p \cap |\varphi|$ is empty

d. For any proposition $P \subseteq \wp(W)$, $P \models \neg\varphi$ iff $p \models Q(\varphi)$ and $p \perp \varphi$ for every $p \in P$

- Note $w(a)$ and $v(a)$ can take values beyond $\{0, 1\}$

Experiment on what negation does to alternatives

Experimental design

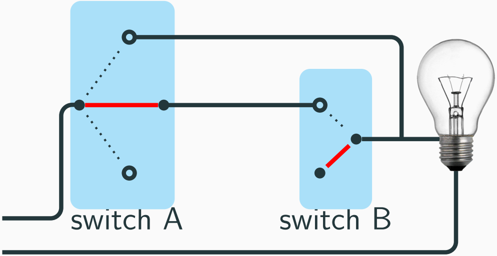


Figure 1: Scenario used in the experiment

Experimental design

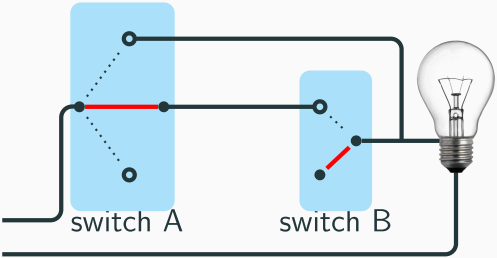
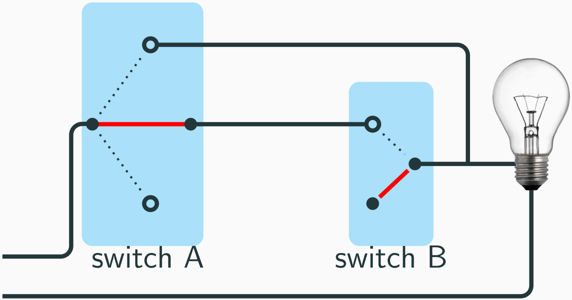


Figure 1: Scenario used in the experiment

- 192 Mechanical Turk participants, excluding:
  - 74 participants who responded ≤ 4 on the True filler;
  - 3 participants who didn't report English as native language
- Each participant only saw one of T1 and T2, in random order with the True and False filler and the Control item, T3 presented last

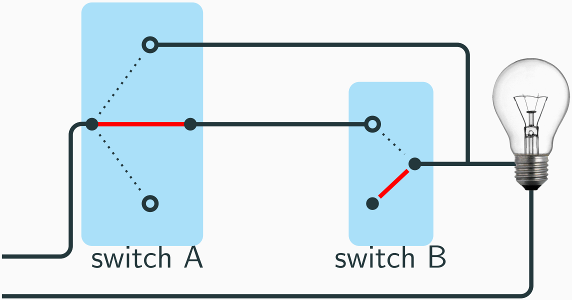
Fillers



False: Currently, switch A is in the middle and switch B is down. If that wasn't the case, the light would be on.

True: Currently, switch A is not up. If that was the case, the light would be on.

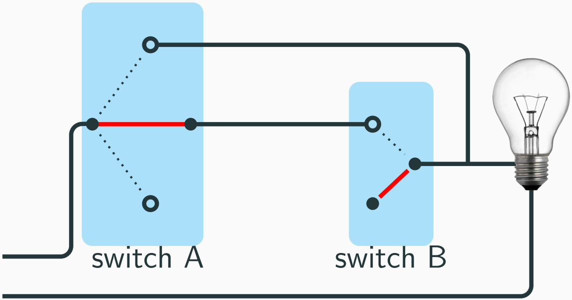
Control



Control: Currently, switch B is down. If that wasn't the case, the light would be on.

- Tests how much the participant keeps fixed

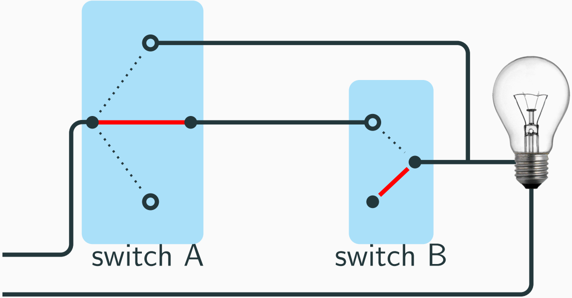
Main test



T1: Currently, neither switch is up. If that wasn't the case, the light would be on.

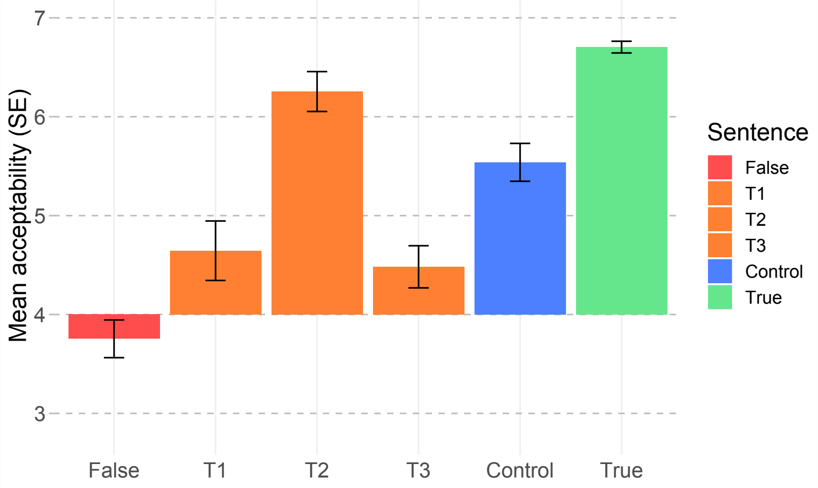
T2: Currently, switch A is in the middle and switch B is down. If switch A was up or switch B was up, the light would be on.

Final test



T3: If switch B was up but not switch A, the light would be on.

Results



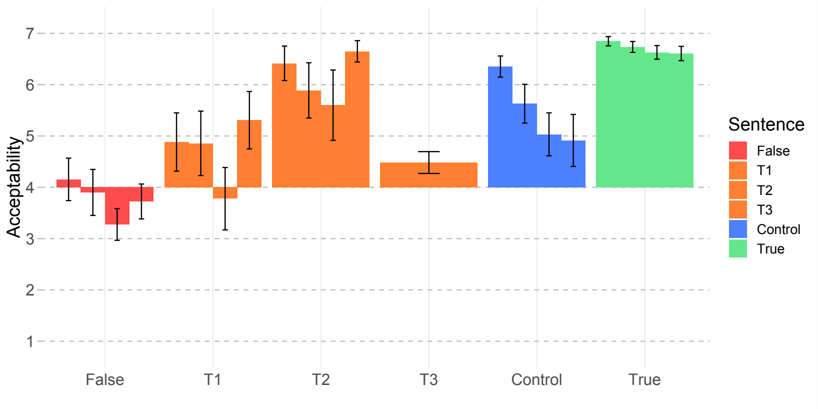
F	T1	T2	T3	C	T
$\neg(A \cdot \wedge B \downarrow)$	$\neg\neg(A \uparrow \vee B \uparrow)$	$A \uparrow \vee B \uparrow$	$B \uparrow \wedge \neg A \uparrow$	$\neg B \downarrow$	$A \uparrow$

Predictions

Theory / Antecedent	T1 $\neg\neg(A\uparrow \vee B\uparrow)$	T2 $A\uparrow \vee B\uparrow$	T3 $B\uparrow \wedge \neg A\uparrow$
Alonso-Ovalle (2006)	✗	✓	✓
Ciardelli et al. (2018)	✗	✓	✓
Fine (2012)	✓	✓	✗
Santorio (2018)	✓	✓	✗
Willer (2018)	✓	✓	✗
Schulz (2018)	✗	✓	✗
Our data (interpreted)	✗	✓	✗

Table 1: Overview of predictions

Order effects



F	T1	T2	T3	C	T
$\neg(A \cdot \wedge B\downarrow)$	$\neg\neg(A\uparrow \vee B\uparrow)$	$A\uparrow \vee B\uparrow$	$B\uparrow \wedge \neg A\uparrow$	$\neg B\downarrow$	$A\uparrow$

Hurford antecedents

Hurford's constraint

- Hurford (1974): a disjunction in which one disjunct entails the other is generally infelicitious

(6) a. #The ring is made of gold or metal.
    b. #John is here, or John is here and Mary is not.

- Hurford's constraint also appears in conditional antecedents.

(7) a. #If the ring is made of gold or metal, it will be heavy.
    b. #If John were here, or John were here but Mary not, he would come to.

Gazdar (1979): some Hurford disjunctions are acceptable

(8) a. Alice ate some or all of the cookies.
    b. John solved there or four of the problems.

Acceptability extends to conditional antecedents:

(9) a. If switch B was up, or switches A and B were up, ...
    b. $B \vee (A \wedge B) > \ldots$

$$[\![B \vee (A \wedge B)]\!] = \{|B|, |A \wedge B|\}^{\downarrow} = \{|B|\}^{\downarrow} = [\![B]\!]$$

where $P^{\downarrow} = \{s \subseteq W \mid s \subseteq t \text{ for some } t \in P\}$.

Exclusive disjunction

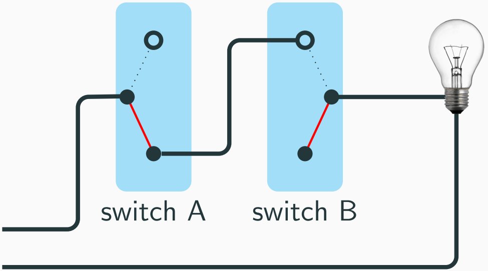


Figure 2: The light is on just in case A is down and B is up.

(10) a. If switch B was up, the light would be on. B

b. If switch B was up, or switches A and B were up, the light would be on. $B \vee (A \wedge B)$

Exhaustivity

Aloni and Ciardelli (2011):

$$s \models \text{exh}(\varphi) \;\Leftrightarrow\; s \subseteq \text{exh}(\alpha, |\mathit{RA}(\varphi)|) \text{ for some } \alpha \in \mathit{Alt}(\varphi)$$

Where

- $|\mathit{RA}(\varphi)| = \{|\psi| \mid \psi \in \mathit{RA}(\varphi)\}$

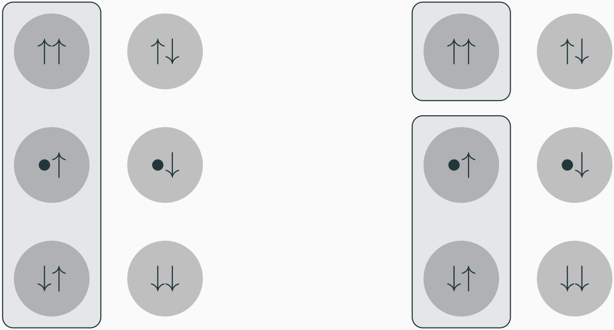
Roelofsen and van Gool (2010):

- $\text{exh}(\pi, \Pi) = \pi - \bigcup\{\pi' \in \Pi \mid \pi \not\subseteq \pi'\}$
- $\text{exh}(\Pi) = \{\text{exh}(\pi, \Pi) \mid \pi \in \Pi\}$

$$\mathit{RA}(a) = \{a\} \cup C_a$$
$$\mathit{RA}(\varphi \vee \psi) = \mathit{RA}(\varphi) \cup \mathit{RA}(\psi)$$
$$\mathit{RA}(\varphi \wedge \psi) = \mathit{RA}(\varphi) \cup \mathit{RA}(\psi)$$

$$\mathit{RA}(\neg\psi) = \{\neg\psi \mid \psi \in \mathit{RA}(\varphi)\}$$
$$\mathit{RA}(\text{exh}(\varphi)) = \{\text{exh}(\psi) \mid \psi \in \mathit{RA}(\varphi)\}$$

where C_a is a set of contextually relevant alternatives to a.



(a) B up $\vee$ (**A up** $\wedge$ **B up**)

(b) $\textsc{exh}$(**B up**) $\vee$ $\textsc{exh}$(**A up** $\wedge$ **B up**)

Figure 3: Exclusification in inquisitive semantics

$$\textsc{exh}(B) \vee \textsc{exh}(A \wedge B) \equiv (B \wedge \neg A) \vee (A \wedge B)$$

Exclusive interpretation

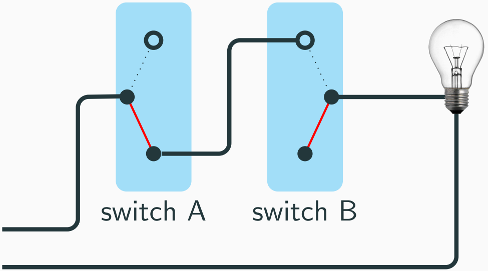


Figure 4: The light is on just in case A is down and B is up.

(11) a. If switch B was up, the light would be on. B

b. If switch B was up (and A not up), or switches A and B were up, the light would be on. $(B \wedge \neg A) \vee (A \wedge B)$

A three-valued switch

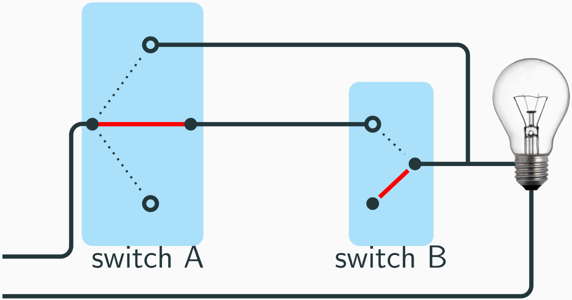


Figure 5: The light is on iff A is up, or A is in the middle and B is up

(12) a. If B was up, the light would be on.
b. If B was up, or A and B were up, the light would be on.
c. If B was up and A not up, or A and B were up, the light would be on.

What negation does to alternatives

Observation

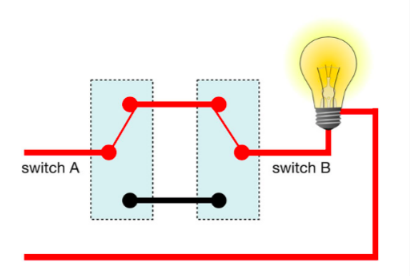
$B \vee (A \wedge B)$ and $(B \wedge \neg A) \vee (A \wedge B)$ seem to raise different hypothetical scenarios

- When A is not mentioned, its position is kept fixed
- When $\neg A$ is mentioned, its position is not kept fixed
    - In particular, $\neg A$ invites considering A being down

Overt versus covert negation

(13) a. If EXH(B was up), or A and B were up, the light would be on.
b. If B was up and A not up, or A and B were up, the light would be on.

- Perhaps EXH should be sensitive to counterfactual alternatives
  - But this invites worries about compositionality
- Perhaps overt negation has extra-semantic effects



(4) a. If switch A or switch B was down, the light would be off.
b. If switch A and switch B were not both up, the light would be off.

Ciardelli et al. (2018) give a semantic explanation of their data via:

- the difference in alternatives between $\neg(A \wedge B)$ and $\neg A \vee \neg B$
- together with their method of adopting hypothetical assumptions

Summary

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- Experimental evidence against
  - Alonso-Ovalle (2006) — alternative semantics
  - Ciardelli et al. (2018) — inquisitive semantics
  - Fine (2012) — truthmaker semantics
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  - Willer (2018) — dynamic semantics
- Our results can be accounted for by adapting the semantic entry for negation
  - Schulz (2018) accounts for our data
- But our results challenge the semantic explanation of the data in Ciardelli et al. (2018)

Maria Aloni and Ivano Ciardelli. A semantics for imperatives, 2011.

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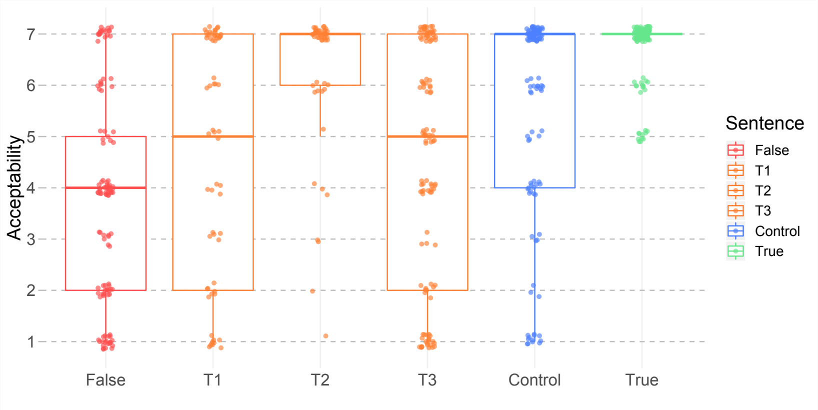
Malte Willer. Simplifying with free choice. *Topoi*, 37(3):379–392, Sep 2018. doi:10.1007/s11245-016-9437-5.

Box plot



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Schulz (2018)'s experiment

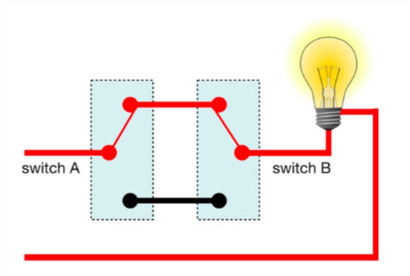

Figure 6: Scenario used in Ciardelli et al. (2018)'s experiment

(14)
a. If the electricity was working, then the light would be on.
b. If the electricity was working and switch A was up, then the light would be on.
c. If the electricity was working and switch A and switch B were not both up, then the light would (still) be off.

Results from Schulz (2018)'s experiment

sentences	true	%	false	%	indet.	%
$E \rightsquigarrow On$	8	16%	42	82%	1	2%
$(E \wedge A) \rightsquigarrow On$	43	84%	5	10%	2	4%
$[E \wedge \neg(A \wedge B)] \rightsquigarrow On$	14	27%	27	53%	8	16%
$[E \wedge \neg(A \wedge B)] \rightsquigarrow On^*$	9	26%	20	59%	5	15%

Figure 7: Results from Schulz (2018)'s experiment

Conclusion

- The mechanism for making hypothetical assumptions in Ciardelli et al. (2018) keeps too much fixed