Negation and Alternatives in Conditional Antecedents

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1. Summary

How are we to decide between the many semantic frameworks available today? We compared semantic frameworks for alternatives by testing their predictions concerning the effects of negation on alternatives in conditional antecedents.

2. Background

- Many semantic frameworks today make use of **alternatives**, where expressions **sets** of their traditional denotations
- These theories differ on the interaction between negation and alternatives; e.g.
  - In **alternative** and **inquisitive semantics**, negated sentences have a single alternative (Alonso-Ovalle, 2006; Ciardelli et al., 2018a)
  - In other frameworks, negated sentences can have multiple alternatives (e.g. Fine, 2017; Willer, 2018; Schulz, 2018)
- In many semantics of conditionals, alternatives play an essential role (see (1))
- This means that the question of which semantic framework to adopt is an empirical question, one that can be experimentally tested using conditional antecedents

3. Theories

(1) **Conditional semantics with alternatives** (Ciardelli, 2016). *If* A, C is true iff for every alternative p of $[\![A]\!]$, there is an alternative q of $[\![C]\!]$ such that $p \Rightarrow q$ holds, where $\Rightarrow$ is given by one's favorite semantics of conditionals, defined over propositions.

Fine (2012) and Willer (2018) predict T1 to be true, and equivalent to T2, by De Morgan's Law:

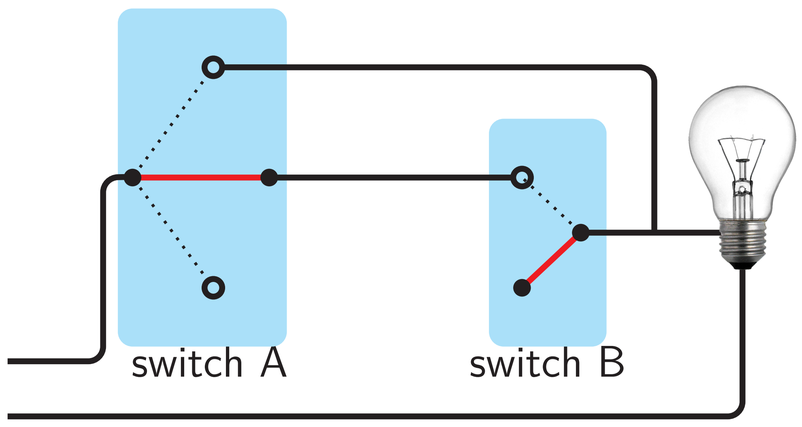
$$\neg\neg(A \vee B) \equiv \neg(\neg A \wedge \neg B) \equiv \neg\neg A \vee \neg\neg B \equiv A \vee B$$

Schulz (2018) points out that, according to both the similarity approach and Ciardelli et al. (2018b)'s background semantics, if A has one alternative and B is currently true, then $A \wedge B$ is equivalent to B in counterfactual antecedents.
$\therefore$ Since negation flattens alternatives in alternative and inquisitive semantics, and $\neg A\uparrow$ is actually true, these theories predict T3 to be true.

Schulz (2018) proposes that negation introduces an extra requirement: $[\![\neg S]\!]$ is the set of states that (i) are truth-conditionally incompatible with S, and (ii) specify all and only the values of each atomic sentence in S (binary: true/false, or n-ary)
$\therefore$ Schulz predicts that T1 and T3 are both false

4. Experiment

- 192 Mechanical Turk participants
- Presented with the wiring diagram on the right, illustrating how lighting in public buildings such as hospitals is often controlled in such a way that a caretaker can lock the lights OFF or ON (by moving switch A in position bottom or top resp.), or leave it under the control of the normal circuit switch B by leaving A in the middle (letting a patient turn the light ON or OFF as they wish).
- Participants were then told that switch A is in the middle and switch B is down, and instructed to rate a few sentences on a scale from 1 (clearly false) to 7 (clearly true).
- Each participant only saw one of T1 and T2, in random order with the True and False filler and the Control item. T3 was presented last, as it had a slightly different structure.
- 74 participants who responded 4 or less on the True filler were excluded from analyses, as well as 3 participants who didn't report English as their native language. Participants were at chance on the False filler (presumably because of an ambiguity regarding the antecedent of 'if that wasn't the case'), so this item was not used as an exclusion criterion.



Scenario used in the experiment

Theory / Antecedent	T1	T2	T3
Our data (interpreted)	✗	✓	✗
Alonso-Ovalle (2006)	✗	✓	✓
Ciardelli et al. (2018b)	✗	✓	✓
Fine (2012)	✓	✓	✗
Willer (2018)	✓	✓	✗
Schulz (2018) binary	✓	✓	✓
Schulz (2018) n-ary	✗	✓	✗

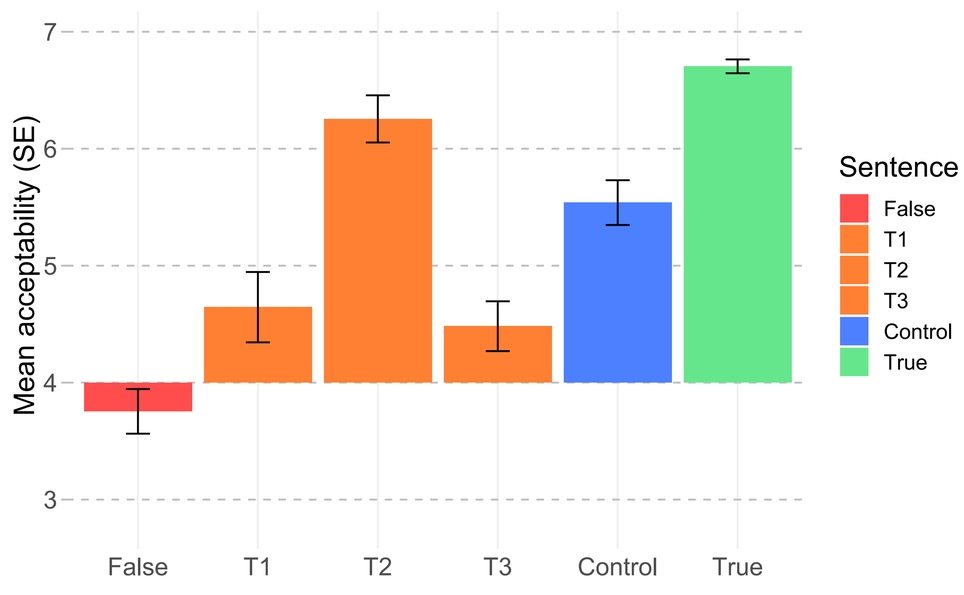
Overview of predictions

5. Sentences tested

False:	Currently, switch A is in the middle and switch B is down. If that wasn't the case, the light would be on.	$\neg(A\bullet \wedge B\downarrow) > \textsc{On}$
T1:	Currently, neither switch is up. If that wasn't the case, the light would be on.	$\neg\neg(A\uparrow \vee B\uparrow) > \textsc{On}$
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.	$A\uparrow \vee B\uparrow > \textsc{On}$
T3:	If switch B was up but not switch A, the light would be on.	$B\uparrow \wedge \neg A\uparrow > \textsc{On}$
Control:	Currently, switch B is down. If that wasn't the case, the light would be on.	$\neg B\downarrow > \textsc{On}$
True:	Currently, switch A is not up. If that was the case, the light would be on.	$A\uparrow > \textsc{On}$

6. Results

A cumulative link mixed model on data from the control and test sentences showed that T1 and T3 were rated significantly lower than the control (both $z < -2.5$, $p < .01$), while T2 was rated significantly higher than control ($z = 2.1, p = .039$). A posthoc comparison of targets T1 and T3 revealed no difference between the two ($z = -0.5, p = .62$).



7. Conclusions

Our results pose a challenge to all contemporary semantics of conditionals based on alternatives we have considered, besides the n-ary version of Schulz (2018). More specifically, our experiment provides evidence that De Morgan's law and double negation elimination are not valid in conditional antecedents, and at the same time supports the view that negated sentences can have alternatives.

8. References

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