Negation and alternatives in counterfactual antecedents

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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 *2* alt(A) there is a q *2* alt(C) such that s $p \vee q$

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

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Each paper has a different semantic entry for negation

Negation flattens alternatives	Alternatives survive negation
Kratzer and Shimoyama (2002)	Fine (2012)
Alonso-Ovalle (2006)	Willer (2018)
Ciardelli et al. (2018)	Santorio (2018)
	Schulz (2018)

Experiment on what negation does to alternatives

Outline

Experimental design

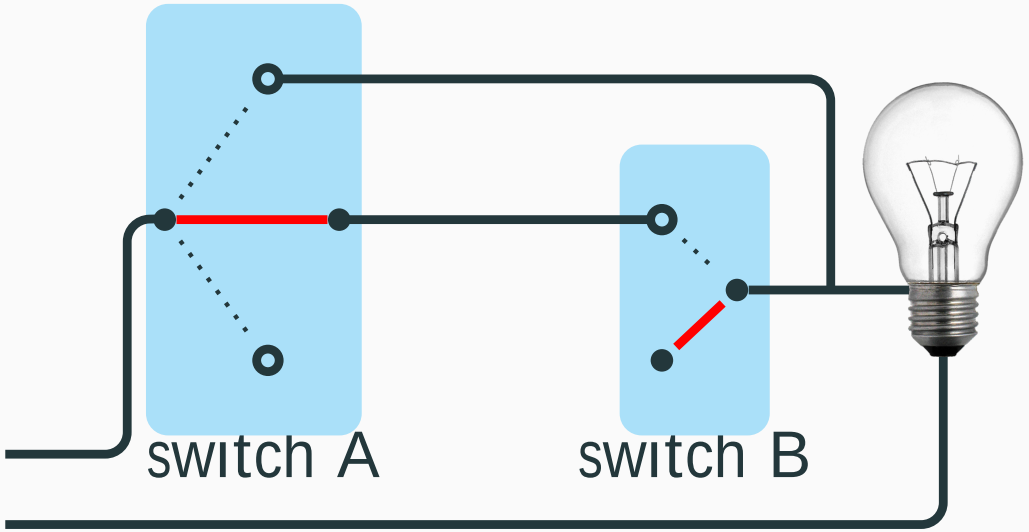
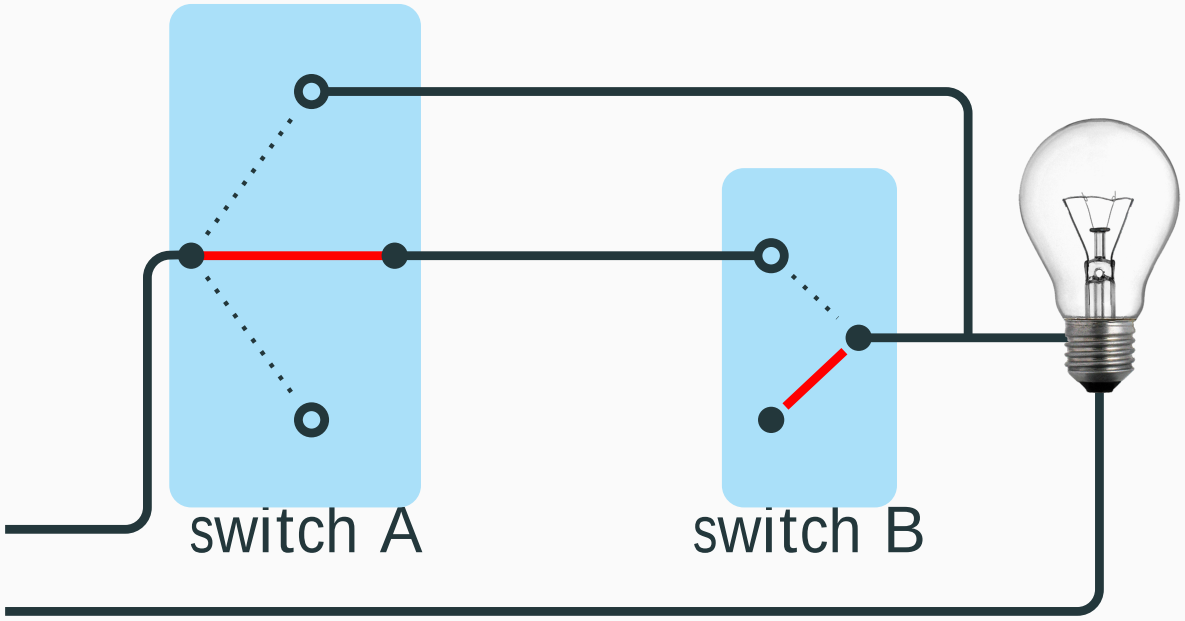


Figure 1: Scenario used in the experiment

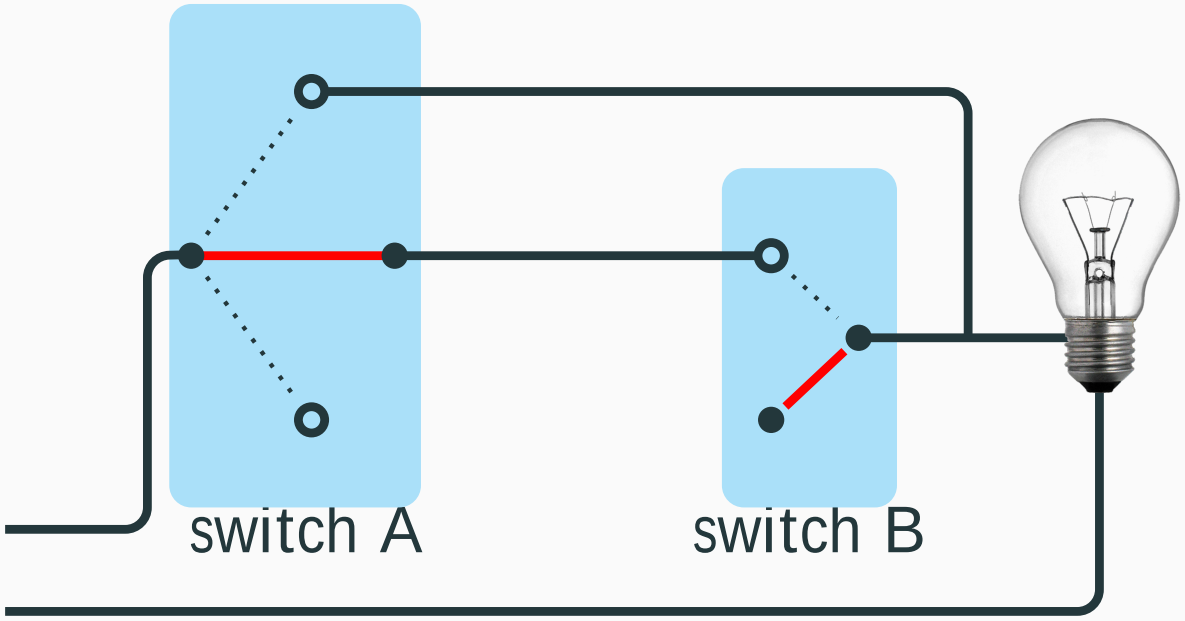
Fillers



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.

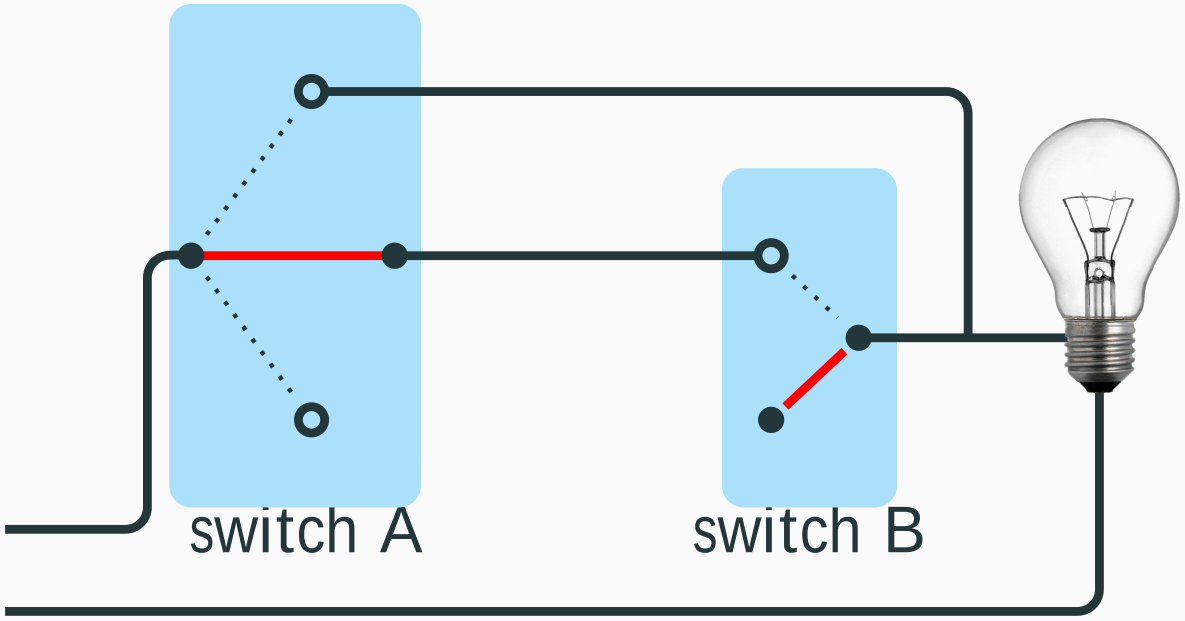
Control



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

- Tests how much the participant keeps fixed

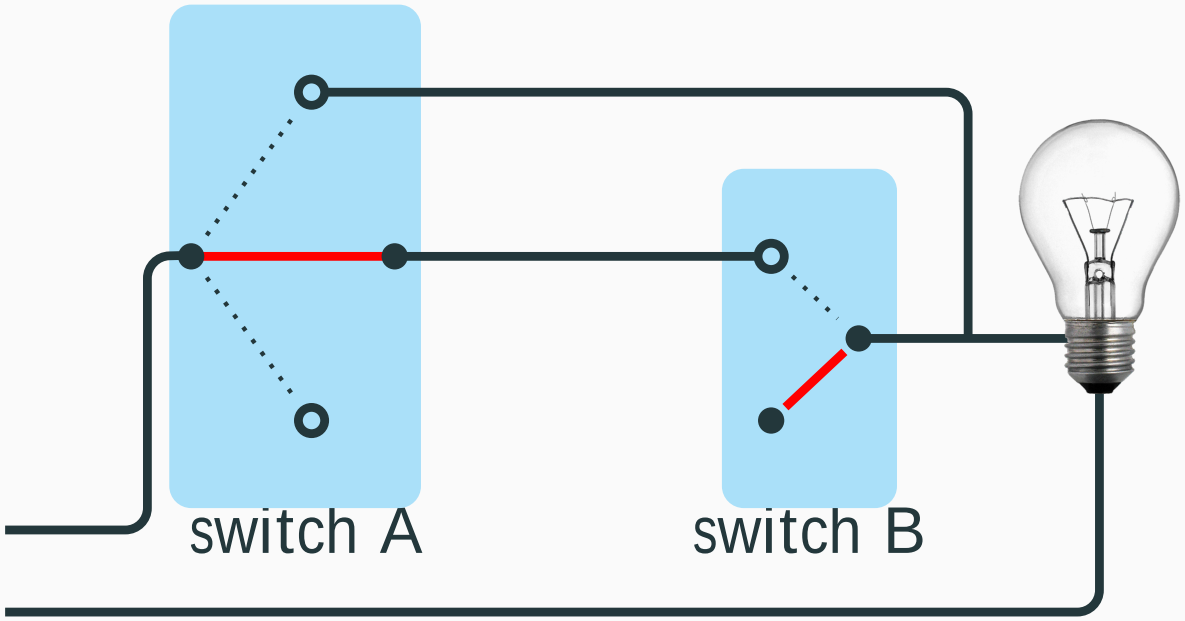
Main test



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.

Outline

Alternatives survive negation just in case $\llbracket A \rrbracket^{g,c}$ can contain multiple elements.

Do alternatives survive negation?

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Do alternatives survive negation?

(4) Kratzer and Shimoyama (2002):
[Neg](A) = *f*the proposition that is true in all worlds in which no proposition in A is true*g*

If alternatives do not survive negation...

$$::(A''\_\ B'') > \textsc{On} \tag{T1}$$

$$6$$

$$A''\_\ B'' > \textsc{On} \tag{T2}$$

If alternatives survive negation...

Disjunction introduces alternatives

Validate De Morgan's law $\quad :(A \wedge B) \quad :A \_ :B$

$\therefore$ Negation introduces alternatives

(5) $\quad ::(A \_ B) \quad :(:A \wedge :B) \quad ::A \_ ::B \quad A \_ B$

T1: Currently, neither switch is up. If that wasn't the case, the light would be on. $\quad ::(A'' \_ B'') > \textsc{On}$

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. $\quad A'' \_ B'' > \textsc{On}$

If alternatives do not survive negation...

Schulz (2018): according to both the similarity approach and Ciardelli et al. (2018)'s background semantics, if A has one alternative and B is true at w, then

$$w \models (A \wedge B) > C \qquad \text{iff} \qquad w \models B > C.$$

T3 If switch B was up but not switch A, the light would be on.
$B'' \wedge :A'' > \textsc{On}$

$$B'' \wedge :A'' > \textsc{On} \qquad\qquad B'' > \textsc{On}$$

If alternatives survive negation...

(6) Switch A is not up Switch A is in the middle or down.

$(B'' \wedge :A'') > \textsc{On}$

$B'' \wedge (A\bullet \_\ A\#) > \textsc{On}$

$(B'' \wedge A\bullet)\ \_\ (B'' \wedge A\#) > \textsc{On}$ (Dist ^ over _)

$)\ (B'' \wedge A\#) > \textsc{On}$ (SDA)

$B'' \wedge :A'' > \textsc{On}$ 6 $B'' > \textsc{On}$

Schulz (2018)

(7) *Schulz negation*

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

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

(i) Binary version: $w(a) \in \{0, 1\}$ for every world w and atomic sentence a.

(ii) n-ary version: $w(a)$ can be outside $\{0, 1\}$.

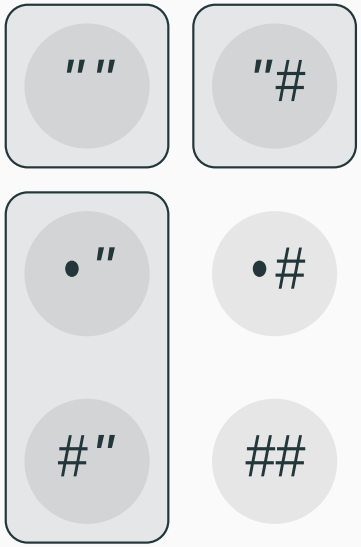
c. For any information state $p \subseteq W$,

(i) $p \models Q(\varphi)$ iff $w \sim_\varphi v$ for every $w, v \in p$ (p 'answers the question raised by φ')

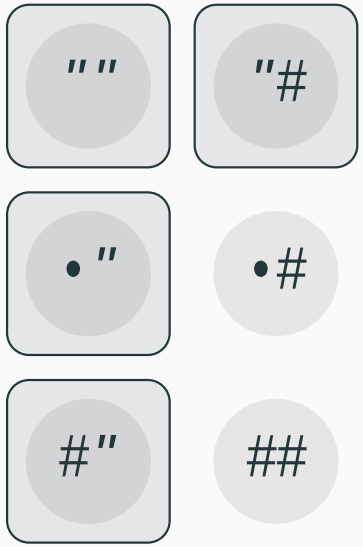
(ii) $p ? \varphi$ iff $p \setminus |\varphi|$ is empty (p and φ are mutually exclusive)

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

e. $[\text{not } \varphi] = \{p \subseteq W : Q(\varphi)$ and $p ? \varphi\}$



(a) Binary atomics



(b) *n*-ary atomics

Figure 2: T1, $::(A" \_ B")$, in Schulz's framework

Overview of predictions

Theory / Antecedent	T1 $::(A" \_ B")$	T2 $A" \_ B"$	T3 $B" \wedge :A"$
Alonso-Ovalle (2006)	7	3	3
Ciardelli et al. (2018)	7	3	3
Fine (2012)	3	3	7
Santorio (2018)	3	3	7
Willer (2018)	3	3	7
Schulz (2018) binary	3	3	7
Schulz (2018) n-ary	7	3	7

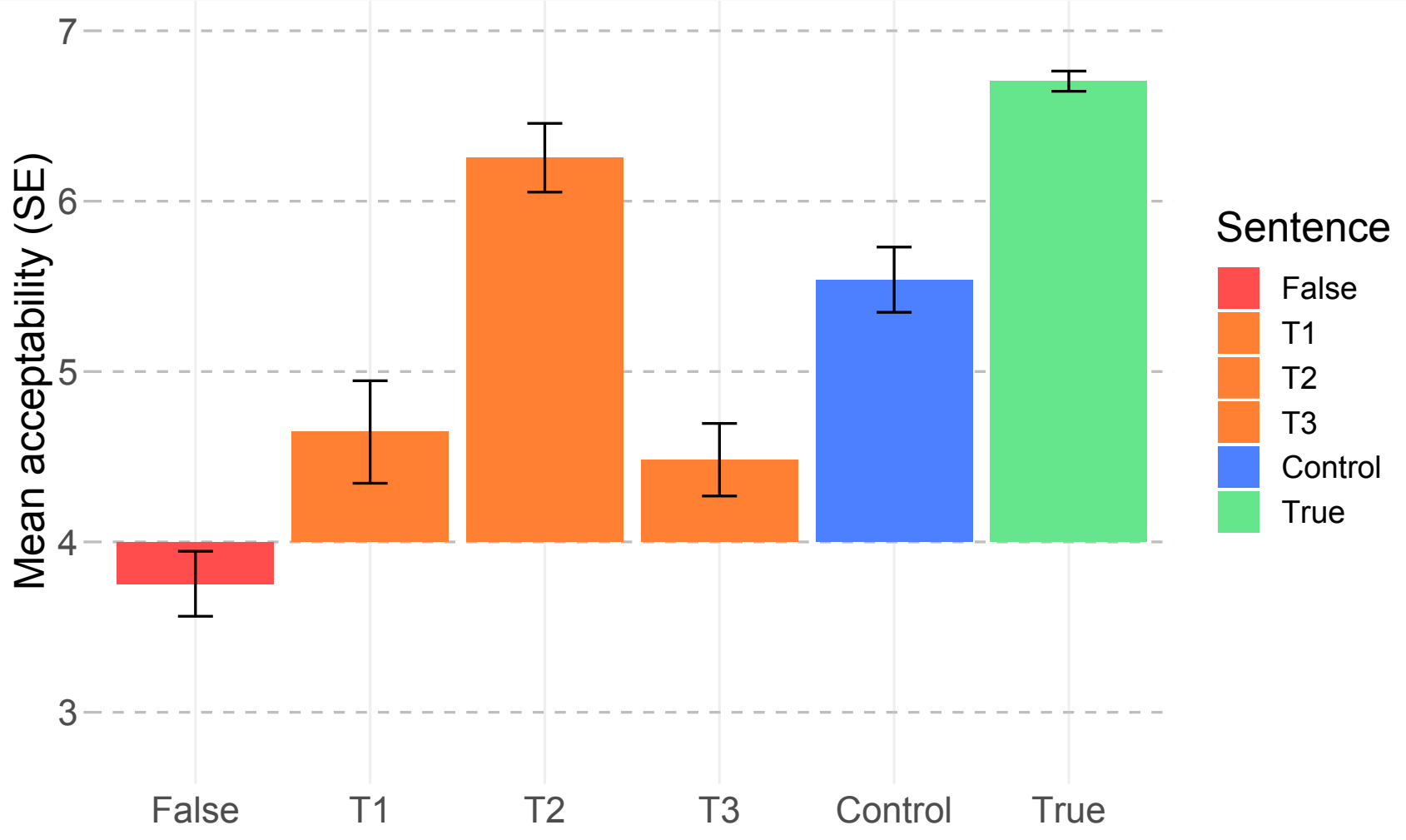
Table 1: Overview of predictions

Experimental setup

- 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

Outline

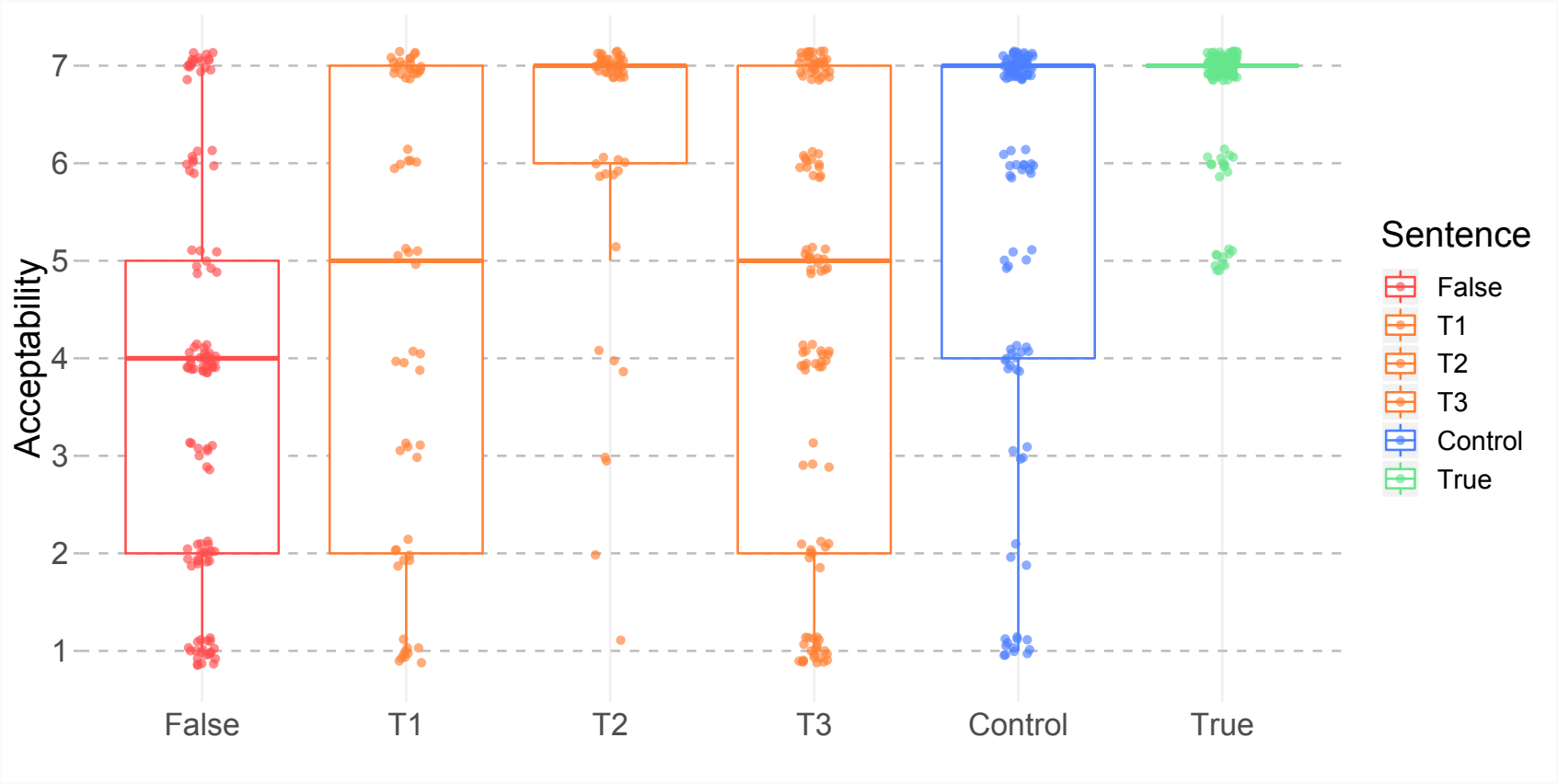
Results



F T1 T2 T3 C T

:(A ^B #) ::(A " _B ") A " _B " B " ^:A " :B # A "

Box plot



;

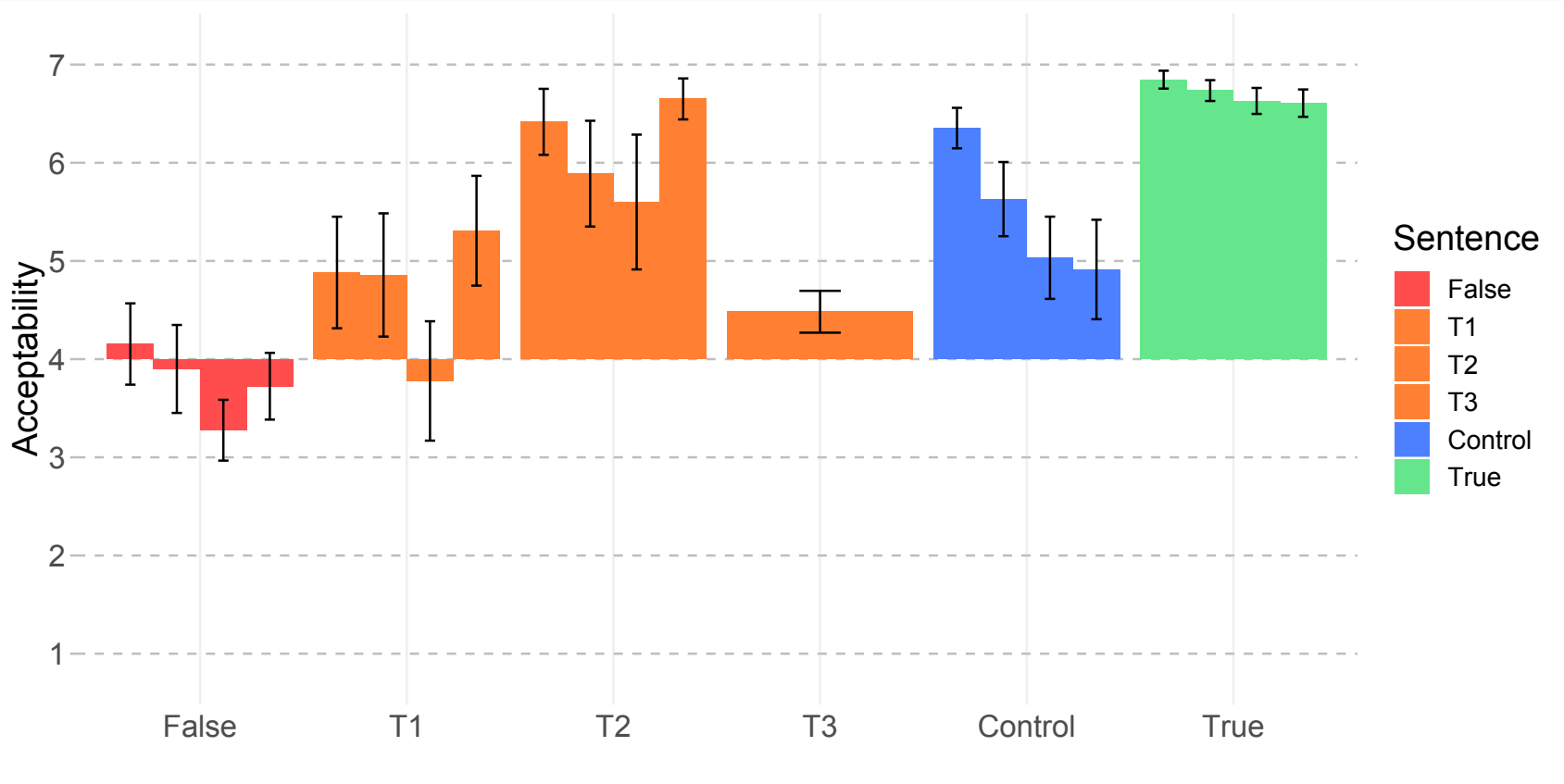
F T1 T2 T3 C T

:(A ^B #) ::(A " _B ") A " _B " B " ^:A " :B # A "

Analysis of results

- Cumulative link mixed model on data from the control and test sentences
- T1 and T3 rated significantly lower than the control (both $z < \quad 2.5$, $p < .01$)
- T2 rated significantly higher than control ($z = 2.1, p = .039$)
- Posthoc comparison of targets T1 and T3 revealed no difference between the two ($z = \quad 0.5, p = .62$)

Order effects



F	T1	T2	T3	C	T
:(A ^B #)	*::(A " _B ")*	*A " _B "*	*B " ^:A "*	*:B #*	*A "*

Discussion

Overview of predictions (interpreted)

Theory / Antecedent	T1 $::(A"\_B")$	T2 $A"\_B"$	T3 $B"\ \hat{}\ :A"$
Our data (interpreted)	7	3	7
Alonso-Ovalle (2006)	7	3	3
Ciardelli et al. (2018)	7	3	3
Fine (2012)	3	3	7
Santorio (2018)	3	3	7
Willer (2018)	3	3	7
Schulz (2018) binary	3	3	7
Schulz (2018) *n*-ary	7	3	7

Table 2: Overview of predictions, with new data

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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  - Schulz (2018) accounts for our data by taking into account the 'question' raised the the conditional antecedent

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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 by taking into account the 'question' raised the the conditional antecedent
- But our results challenge a purely semantic explanation of the data

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Schulz (2018)'s experiment

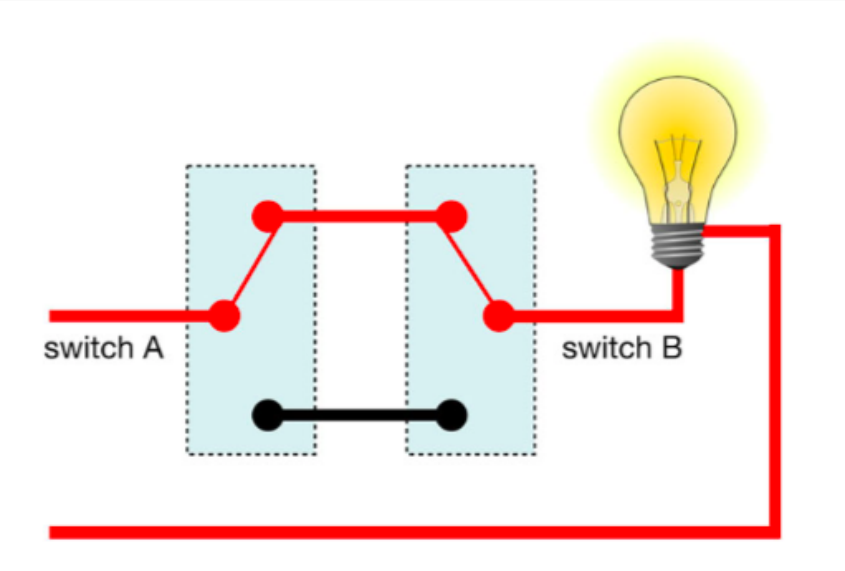

Figure 3: Scenario used in Ciardelli et al. (2018)'s experiment

(8) 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 4: Results from Schulz (2018)'s experiment

Conclusion

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