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Negation and Alternatives in Conditional Antecedents

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Abstract

A number of authors, beginning with Alonso-Ovalle (2006), have used conditional antecedents to argue for the presence of alternatives in semantics. In this tradition, recent experimental work from Ciardelli et al. (2018b) and Schulz (2018) uses data from conditional antecedents to investigate the interaction between negation and alternatives. We contribute to this line of inquiry with an experiment to test a number of semantics of conditionals through their predictions on the relationship between alternatives and negation (namely, Fine, 2012; Alonso-Ovalle, 2006; Ciardelli et al., 2018b; Willer, 2018; Schulz, 2018). We find experimental support for a variant of Schulz's theory and against all other accounts we consider.

1 Introduction

Ever since Hamblin (1973), many semanticists have felt the need to enrich their semantic framework so that expressions do not have their 'traditional' denotation, but are represented as sets of such denotations. The traditional denotations are then known as an expression's alternatives. Alternatives have been applied in the semantics of questions (e.g. Hamblin, 1973; Ciardelli et al., 2018a), indefinites (e.g. Kratzer and Shimoyama, 2002), quantified expressions (e.g. Hagstrom, 1998; Shimoyama, 2001), modals (e.g. Simons, 2005; Aloni, 2007), conditionals (e.g. Alonso-Ovalle, 2006; Santorio, 2018), unconditionals (Rawlins, 2008), and exclusive strengthening operators (Menéndez-Benito, 2005; Alonso-Ovalle, 2006; Roelofsen and van Gool, 2010), to name a few.

While the importance of alternatives in semantics is widely acknowledged, different authors use different frameworks to represent them. As Ciardelli et al. (2017) and Ciardelli and Roelofsen (2017) point out, different frameworks for alternatives make different predictions, making the choice of which framework to adopt an empirical issue. This is especially true in the semantics of conditionals. Conditional antecedents offer an interesting test case for broader issues in the semantics of alternatives. This is due to the idea—going back to Alonso-Ovalle (2006) and variously implemented since—that the truth conditions of conditionals involve direct quantification over the antecedent's alternatives. Ciardelli (2016) represents this idea schematically in (1) (we have rephrased Ciardelli's scheme to apply generally, since the scheme is written to apply to inquisitive semantics).

(1) **Conditional semantics scheme** (Ciardelli, 2016): A conditional *if* A, C is true just in case for every alternative p of $[\![A]\!]$, there is an alternative q of $[\![C]\!]$ such that $p \Rrightarrow q$ holds, where $\Rrightarrow$ is given by one's favorite semantics of conditionals, defined over propositions.

Beginning with the work of Alonso-Ovalle (2006), there are now a number of semantics of conditionals that appeal to alternatives. Table 1 provides an overview of recent contributions.

Somewhat bewilderingly, each theory listed in Table 1 proposes a different entry for negation. One particular difference between them concerns whether negated expressions can have multiple alternatives. To illustrate, while recent semantics of conditionals that use alternatives all agree that (2a)'s antecedent raises two distinct alternatives, they disagree as to whether a negated antecedent, as in (2b), raises one or many alternatives.

Semantics of conditionals	Semantic framework
Alonso-Ovalle (2006)	Alternative semantics (e.g. Hamblin, 1973; Kratzer and Shimoyama, 2002)
Fine (2012)	Truthmaker semantics (Fine, 2017)
Willer (2018)	Dynamic semantics (Veltman, 1996), enriched with alternatives
Ciardelli et al. (2018b)	Inquisitive semantics (Ciardelli et al., 2018a)
Schulz (2018)	Inquisitive semantics with a modified clause for negation

Table 1: Recent work in the semantics of conditionals that uses alternatives

(2) a. If you had taken the train or the metro, you would have arrived on time.
b. If Mary and her ex husband had not both come to the party, we would've had more fun.

The interaction between negation and alternatives offers a useful dimension by which to compare frameworks for alternatives, and thereby attain a greater understanding of the empirical adequacy of a number of frameworks for alternatives simultaneously.

We therefore ran an experiment to test the predictions of each of the theories listed in Table 1, using a design similar to that of (Ciardelli et al., 2018b, henceforth: CZC). Specifically, we investigated the interaction between negation and alternatives in conditional antecedents.

2 The role of alternatives in conditional antecedents

A central reason why Alonso-Ovalle (2006) introduced alternatives into the semantics of conditionals was to prohibit an unwanted interaction observed between the disjuncts of a disjunctive conditional antecedent. His example, based on Nute (1975), is (3).

(3) If we had had good weather this summer or the sun had grown cold, we would have had a bumper crop.

In the semantics of Stalnaker (1968) and Lewis (1973), a counterfactual is true just in case its consequent holds in all the most similar worlds to the actual world that make the antecedent true. Presumably, since the sun growing cold is such a bizarre event, in all the most similar worlds to the actual world where there is good weather this summer or the sun grows cold, there is good weather this summer, in which case we have a bumper crop. However, unlike the semantics of similarity, on hearing (3) speakers do not ignore the scenario where the sun grows cold, in which case there is not a bumper crop.

Since the theory of Stalnaker (1968); Lewis (1973) only takes the truth conditions – or, *informative content* – of the antecedent into account, it allows the two disjuncts of a disjunctive antecedent to interact when they are fed into the mechanism for making counterfactual assumptions. In this case, it is the striking difference in similarity between the two disjuncts in (3) that results in the semantics ignoring the scenario where the sun grows cold.

Alternatives in semantics offer one way to avoid such interaction. This is because they allow one to feed the alternatives of conditional antecedent separately into the mechanism for making counterfactual assumptions, as shown in (1).

2.1 Negation as an alternative-flattener: a problem

Schulz (2018) has shown that a version of the problem that Alonso-Ovalle pointed out for Lewis and Stalnaker also arises for alternative and inquisitive semantics. This is because negation in alternative and inquisitive flattens alternatives, in the sense that negated expressions always have a single alternative. In these frameworks, then, the advantages brought by alternatives into the semantics of conditionals cannot be transferred to negated antecedents. In alternative and inquisitive semantics, the contribution of a negated antecedent is based on its informative content alone.

Schulz (2018) presents experimental evidence that alternatives can survive negation. Schulz adapts the scenario from CZC, where a light is on just in case the electricity is working and both switches are in the same position. Currently, the electricity is working, switch A is up and switch B is down, so the light is off, as shown in Figure 1.

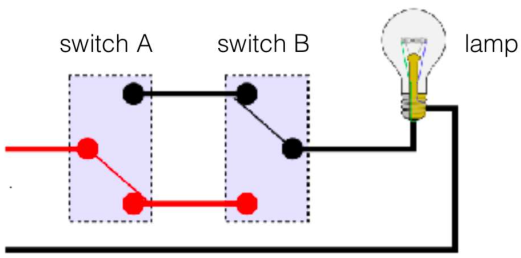

Figure 1: Scenario tested by Schulz (2018)

(4) a. If the electricity was working, then the light would be on. $E > \textsc{On}$

b. If the electricity was working and switch A was up, then the light would be on. $(E \wedge A) > \textsc{On}$

c. If the electricity was working and switch A and switch B were not both up, then the light would (still) be off. $[E \wedge \neg(A \wedge B)] > \textsc{On}$

Sentences	True	%	False	%	Indet.	%
$E > \textsc{On}$	8	16%	42	82%	1	2%
$(E \wedge A) > \textsc{On}$	43	84%	5	10%	2	4%
$[E \wedge \neg(A \wedge B)] > \textsc{Off}$	14	27%	27	53%	8	16%
$[E \wedge \neg(A \wedge B)] > \textsc{Off}^*$ (filtered results)	9	9%	20	59%	5	15%

Table 2: Results from Schulz (2018)

As Table 2 shows, a majority of participants in Schulz's experiment judged (4c) to be false. This is not predicted by alternative and inquisitive semantics, either under the similarity approach or the background semantics proposed by CZC (§4). Regarding the similarity approach, first note that in the actual scenario the switches are not both up. Then intuitively, the most similar world to the actual world where the electricity is on and the switches are both up is one where the electricity is on and the switches are untouched. In this case the light is off, so the similarity approach predicts the truth of (4c). We achieve the same result under the background semantics proposed by CZC.[1]

2.2 Negation without alternative-flattening

One might conclude from Schulz (2018)'s results that, unlike in alternative and inquisitive semantics, negated conditional antecedents should be capable of having multiple alternatives. Under this strategy, the solution Alonso-Ovalle proposed for disjunctive conditional antecedents in response to (3) can be extended to negated conditional antecedents.

Fine (2012), Willer (2018) and Schulz (2018) offer semantics for conditionals where negations can have multiple alternatives. Fine (2012) and Willer (2018) validate De Morgan's law, and therefore face the challenge posed by CZC, who offer evidence De Morgan's law fails for conditional antecedents. However, Willer suggests that one explanation of their data is due to the particular construction of the sentences they tested, in particular their use of 'both' (Willer, 2018, p. 390). To replicate CZC's results, we sought to test a different equivalence, that of $\neg\neg(A \vee B)$ and $A \vee B$, without using 'both' as a scope marker. The equivalence of $\neg\neg(A \vee B)$ and $A \vee B$ is validated by Fine and Willer.[2]

In contrast, Schulz (2018) does not validate De Morgan's law, nor the equivalence of $\neg\neg(A \vee B)$ and $A \vee B$. Schulz adopts inquisitive semantics but proposes that negation introduces an extra requirement on alternatives, one not found in unnegated antecedents: the meaning of a negated sentence $\neg S$ is given by 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.

For reasons that we discuss in section 4.2, we introduce both a binary and n-ary version of Schulz's theory.

(5) *Schulz negation*

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 $a \in \mathcal{L}(\varphi)$

(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) $p \perp \varphi$ iff $p \cap |\varphi|$ is empty (p and φ are mutually exclusive)

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

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

[1] Since the background semantics of CZC is rather new, we show this fact here. CZC account for their data by assuming what they call a 'maximal background', according to which, given an alternative a of the antecedent, we fix the value of every fact that is not called into question by a. According to CZC, since the antecedent of (4c) contains a single alternative, to assess (4c) we fix the value of every fact that is not called into question by the proposition $|E \wedge \neg(A \wedge B)|$, where 'calling a fact into question' is a technical term defined in their paper. Since the scenario of Figure 1 has a particularly simple causal structure (the causal graph representing it consists of just three arrows from the electricity, switch A and switch B, respectively, to the light), calling a fact into question amounts to contributing to its falsity (cf. definition 4 in CZC). To check whether the fact that switch A is down contributes to the falsity of $E \wedge \neg(A \wedge B)$, we have to find a set of actual facts $F \subseteq \{\neg E, \neg A, B, \neg L\}$ such that F is consistent with $E \wedge \neg(A \wedge B)$ but $F \cup \{\neg A\}$ is not. It is easily checked that no such set of facts exists. Similarly, one can show that the fact B *is up* does not contribute to the falsity of $E \wedge \neg(A \wedge B)$.

[2] To see this, note that all semantic frameworks agree that $\neg\neg(A \vee B)$ is equivalent to $\neg(\neg A \wedge \neg B)$. Then by De Morgan's law $\neg(\neg A \wedge \neg B)$ is equivalent to $\neg\neg A \vee \neg\neg B$, which is equivalent to $A \vee B$ when A and B are atomic.

3 Our experiment

We presented 192 Mechanical Turk participants with the wiring diagram in Fig. 2, 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.

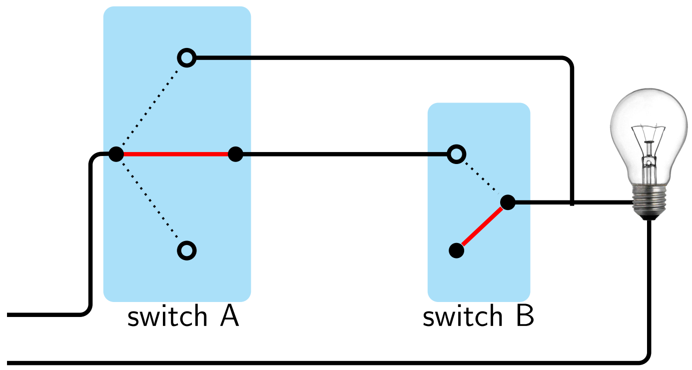

Figure 2: Scenario used in the experiment

Let us use $A\uparrow$, $A\bullet$ and $A\downarrow$ to denote that switch A is up, in the middle and down, respectively, and $B\uparrow$ and $B\downarrow$ to denote that switch B is up and down, respectively. Of course, the logical formulas representing the sentences in (6) did not feature in the experiment.

(6) **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. $A\uparrow > \textsc{On}$

4 Predictions

4.1 Theories where negation flattens alternatives

Alonso-Ovalle (2006) and CZC predict T1 to be false. To see this for the similarity approach, note that the world where switch A is down and B is up is among the most similar worlds to the actual one where $\neg\neg(A{\uparrow} \vee B{\uparrow})$ is true.[3] Alonso-Ovalle (2006) and CZC predict T2 to be true, since the antecedent $A{\uparrow} \vee B{\uparrow}$ raises two alternatives. These alternatives are each hypothetically assumed separately, making $(A{\uparrow} \vee B{\uparrow}) > \textsc{On}$ equivalent to the conjunction $(A{\uparrow} > \textsc{On}) \wedge (B{\uparrow} > \textsc{On})$. Finally, they both predict T3 to be false. This is for the same reason they predict (4c) to be false, as we saw in section 2.1. For instance, on the similarity approach, the world where A is kept in the middle and B is up is more similar to the actual one where A is allowed to vary. (For the background semantics, the same reasoning as in footnote 1 applies.)

4.2 Theories where negation does not flatten alternatives

As mentioned in section 2.2, Fine and Willer predict the equivalence of T1 and T2. Furthermore, they predict both T1 and T2 to be true. But since these theories allow negated antecedents to have many alternatives, they predict T3 to be false. To see this, note that Fine and Willer (2018) can predict that (7a) and (7b) have the same alternatives.

(7) a. Switch A is not up.
b. Switch A is in the middle or down.

Then as these two systems validate the distribution of conjunction of disjunction, and simplification of disjunctive antecedents, they predict the falsity of T3, as shown in (8).

(8) a. If switch B was up but not A, the light would be on. $(B{\uparrow} \wedge \neg A{\uparrow}) > \textsc{On}$
b. ⇔ If switch B was up but A was in the middle or down, the light would be on. $B{\uparrow} \wedge (A\bullet \vee A{\downarrow}) > \textsc{On}$
c. ⇔ (*by distribution of* $\wedge$ *over* $\vee$): If switch B was up and A was in the middle, or B was up and A was down, the light would be on. $(B{\uparrow} \wedge A\bullet) \vee (B{\uparrow} \wedge A{\downarrow}) > \textsc{On}$
d. ⇒ (*by simplification*): If B was up and A was down, the light would be on. $(B{\uparrow} \wedge A{\downarrow}) > \textsc{On}$

[3] CZC's background semantics also predicts T1 to be true. To see this, note that the facts $A\bullet$ and $B{\downarrow}$ are both individually consistent with $\neg\neg(A{\uparrow} \vee B{\uparrow})$; after all, $A\bullet \wedge B{\uparrow}$ and $(A{\uparrow} \wedge B{\downarrow})$ are both possible. However, their conjunction $(A\bullet \wedge B{\downarrow})$ is not consistent with $\neg\neg(A{\uparrow} \vee B{\uparrow})$. Thus the facts $A\bullet$ and $B{\downarrow}$ both contribute to the falsity of $\neg\neg(A{\uparrow} \vee B{\uparrow})$ in the actual world. $B{\downarrow}$ contributes to the falsity of $\neg\neg(A{\uparrow} \vee B{\uparrow})$, since e.g. $\{A\bullet\}$ is consistent with $|\neg\neg(A{\uparrow} \vee B{\uparrow})|$, but $\{A\bullet, B{\downarrow}\}$ is not. And $A\bullet$ contributes to the falsity of $\neg\neg(A{\uparrow} \vee B{\uparrow})$, since e.g. $\{B{\downarrow}\}$ is consistent with $|\neg\neg(A{\uparrow} \vee B{\uparrow})|$, but $\{A\bullet, B{\downarrow}\}$ is not.

So according to CZC these two facts are not backgrounded on the default option of a maximal background; in other words, we do not fix at its actual value the position of switch A or B. So they predict that when listeners counterfactually imagine $\neg\neg(A{\uparrow} \vee B{\uparrow})$, they consider all positions of switches A and B where that sentence is true. These are, with their corresponding outcomes for the light:

$A{\uparrow}$ and $B{\uparrow}$	$A{\uparrow}$ and $B{\downarrow}$	$A\bullet$ and $B{\uparrow}$	$A{\downarrow}$ and $B{\uparrow}$
On	On	On	Off

Note the final scenario: when switch A is down and switch B is up, the light is off. CZC therefore predict the counterfactual $\neg\neg(A\ up \vee B\ up) > On$ to be false. Note that they make this prediction regardless of the background parameter. We have just shown the prediction to hold for a maximal background, but since the scenario where switch A is down and B is up is considered under a maximal background, and any non-maximal background only brings more scenarios into consideration, the scenario where switch A is down and B is up is considered under every background.

The last sentence is quite clearly false, since the light is never on when switch A is down. Willer (2018) therefore predicts the falsity of T3 (8a).

Schulz (2018) presents her clause for negation in a bivalent system: a proposition p "answers the question" raised by an atomic sentence a just in case p determines whether a is true or false. In our experiment, switch A could take three values: up, middle or down. Schulz's prediction for T1 depends on whether one uses her bivalent formulation or switches to one where variables can take arbitrary arity. In the bivalent formulation, there are four maximal states that answer the question raised by the set of atomics $\{A\!\uparrow, B\!\uparrow\}$:

$$|A\!\uparrow \wedge B\!\uparrow| \qquad |A\!\uparrow \wedge \neg B\!\uparrow| \qquad |\neg A\!\uparrow \wedge B\!\uparrow| \qquad |\neg A\!\uparrow \wedge \neg B\!\uparrow|$$

However, in the n-ary formulation, there are six states: each one determining not only whether A is up and whether B is up, but the exact position of each switch.

$$|A\!\uparrow \wedge B\!\uparrow| \quad |A\!\uparrow \wedge B\!\downarrow| \quad |A\bullet \wedge\ B\!\uparrow| \quad |A\!\downarrow \wedge B\!\uparrow| \quad |A\bullet \wedge\ B\!\downarrow| \quad |A\!\downarrow \wedge B\!\downarrow|$$

(a) Binary atomics (b) n-ary atomics

Figure 3: T1, $\neg\neg(A\!\uparrow \vee B\!\uparrow)$, in Schulz's framework

The binary version predicts T1 to be true. For the two alternatives where switch A is up, the light is on, so the only alternative that could make the consequence false is $|(A\bullet \vee A\!\downarrow) \wedge B\!\uparrow|$. Now, under the background semantics of CZC, the fact that switch A is in the middle does not contribute to the falsity of this alternative, $|(A\bullet \vee A\!\downarrow) \wedge B\!\uparrow|$. So the binary version predicts that we keep the position of switch A fixed when hypothetically entertaining that alternative. Since the fact that B is down does contribute to the falsity of that alternative (indeed it is inconsistent with that alternative), we do not keep the position of B fixed. And in that case, the only scenario to check is the one where switch A is in the middle and switch B is up, in which case the light is on. Hence the binary version of Schulz's theory predicts T1 to be true. In contrast, in the n-ary version, one alternative is $|(A\!\downarrow \wedge B\!\uparrow)|$. In that scenario, the light is off, making T1 false.

As T2 does not involve negation, and Schulz (2018)'s theory only differs from CZC in respect of negation, Schulz makes the same prediction regarding T2; namely, that it is true.

Schulz (2018) predicts T3 to be false, both on the binary and n-ary formulation. In the binary formulation, $|(A\!\uparrow \vee A\!\downarrow) \wedge B\!\uparrow|$ is one alternative raised by the antecedent $\neg(A\bullet \wedge B\!\downarrow)$. Since $A\bullet$ and $B\!\downarrow$ are each consistent on their own (i.e. consistent with the empty set of facts), but are inconsistent with $|(A\!\uparrow \vee A\!\downarrow) \wedge B\!\uparrow|$, according to the mechanism of making counterfactual assumptions proposed by CZC, the facts $A\bullet$ and $B\!\downarrow$ both contribute to the falsity of $\neg(A\bullet \wedge B\!\downarrow)$, and hence are not fixed to their actual values. Then when we hypothetically assume the alternative $|(A\!\uparrow \vee A\!\downarrow) \wedge B\!\uparrow|$, we consider two scenarios: both switches being up, and switch A being up and switch B being down. In this latter case, the light is off, making the counterfactual as a whole false. Similarly, in the n-ary formulation, $|A{\downarrow} \wedge B{\uparrow}\,|$ is one alternative raised by the antecedent $\neg(A\bullet \wedge B{\downarrow})$. In this scenario, the light is off and so the counterfactual F: $\neg(A\bullet \wedge B{\downarrow}) > \mathit{On}$ is false.

5 Results

The results of the experiment are depicted in Figure 4. 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 ($z = -0.5, p = .62$).

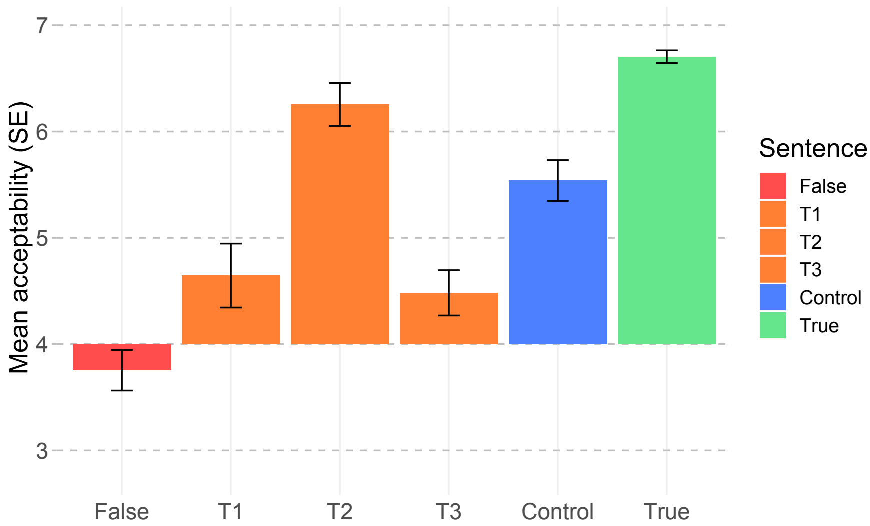

Figure 4: Mean and SE acceptability of each experimental item

We interpret our data as indicating that T1 and T3 are false, and that T2 is true. Table 3 provides an overview of the theories we have considered here and their predictions.

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

Table 3: Overview of predictions and results

6 Discussion

The results of our experiment pose a challenge to all contemporary semantics of conditionals based on alternatives we have considered, besides the n-ary version of Schulz (2018). Most surprising of all is our experimental support for Schulz's unique and entirely novel requirement on the semantics of negation.

Our paper also makes a new contribution to the debate surrounding the interpretation of the experimental results from Ciardelli et al. (2018b). Their data previously suggested against semantic frameworks for conditionals that validate De Morgan's law (e.g. Lewis, 1973; Fine, 2012; Santorio, 2018; Willer, 2018). However, Willer (2018, 390) suggests an alternative explanation for the results of Ciardelli et al.; in particular, by pointing out the undue influence of the word "both" in their experiment. Since any semantic framework validating De Morgan's law also predicts the equivalence of T1 and T2, our experiment contributes independent evidence—using previously untested sentences without "both"—against De Morgan's law in conditional antecedents.

Our study has its own limitations of course. To reduce the complexity of some counterfactual antecedents and avoid overt double negations, we resorted to sentential anaphora in T1, the control, and the false filler: We first introduced a sentence to be used as an antecedent, followed by a counterfactual of the form "if that wasn't the case", where 'it' was to be understood as the previous sentence. There is of course a risk that participants may have interpreted these sentences differently, and that seems to have been the case for the false filler. Unlike the two others, the antecedent sentence contained a conjunction, and it may very well be that some participants resolved 'it' as referring to the second conjunct rather than the whole conjunction. This would explain while many accepted this sentence. Crucially however, in the case of T1 and the control, we do not see any salient alternative to the resolution we intended. A more general issue is the sheer complexity of the scenario we tested, reflected in the number of participants we had to exclude (similar to Ciardelli et al.'s original study). Unfortunately, this seems to be an inherent limitation of this experimental design, but to the extent that we find clear contrasts between the different sentences we tested, these differences still call for an explanation.

Finally, we would like to come back to the mismatch between our results and Ciardelli et al.'s proposal. While Schulz's results calls for a modification of the role of negation in inquisitive semantics, this is not an issue here: inquisitive semantics correctly predicts the difference between T1 and T2. Instead, the problem comes from Ciardelli et al.'s assumptions about backgrounding, which fail to capture T3 (because $A\bullet$ does not contribute to the falsity of $A\uparrow$). A possible fix then, would be to assume that any fact that is mentioned cannot be backgrounded. At this point, one may question how much we want to encode in the semantics, and what should be left to pragmatics. Ciardelli et al. propose a background *semantics*, but the departures needed to account for the results presented here and in Schulz (2018) suggest that it may be a matter of pragmatics more than semantics, as it must be sensitive to the form of the antecedent and not just its semantic content.

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