Do Scalar Alternatives Provide Enough Truthmakers?

A Note on *Santorio, Paolo (2015) "Alternatives and Truthmakers in Conditional Semantics"*

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1 Introduction

Santorio's paper claims that the interpretation of counterfactuals depends on a set of *truthmakers*, which he takes to be propositional alternatives that correspond to certain ways in which the antecedent is true.

The analysis has two components:

1. a proposal about how this set of propositional alternatives is determined, and
2. a proposal about how the consequent of the conditional interacts with this set.

The idea that the interpretation of counterfactuals is sensitive to a set of propositional alternatives is not new within the linguistics literature (see, for instance, Alonso-Ovalle 2004, 2005, 2006, 2008, 2009), but both components of Santorio's proposal move beyond previous proposals in really fruitful ways. Today, I will focus on the first component of his paper.

Take-home message

1. Santorio's proposal about how the propositional alternatives are determined has an advantage over previous proposals, but
2. it still does not provide enough propositional alternatives to capture the natural interpretation of disjunctive counterfactuals.
3. Making the algorithm more liberal might require departing from the claim that it is parallel to what computing scalar implicatures requires.

Preview

- Section 2 reviews the problem that disjunctive antecedents pose and the type of strategy that Santorio's paper (in the spirit of some previous proposals) pursues.
- Section 3 reviews the algorithm that determines the *truthmakers*.
- Section 4 probes into this algorithm and concludes that it does not derive enough truthmakers.
- I conclude by exploring a possible direction to go.

2 The problem and a strategy to solve it

2.1 The problem

Ingredient 1: A superlative semantics for counterfactuals. (Stalnaker, 1968; Lewis, 1973a,b)

(1) If Professor English had presented, the Dean would have been happy.

(2) a. $[\![\text{Professor English presents}]\!] = \{w \mid \text{Prof. English presents in } w\} (:= \textsc{English})$
b. $[\![\text{the Dean would have been happy}]\!] = \{w \mid \text{the Dean is happy in } w\} (:= \textsc{Dean})$

(3) $w' \leq_w w''$ iff w' is at least as similar to w as w'' is.

(4) $\mathsf{closest}_{\leq_w}(\textsc{English}) = \{w' \mid w' \in \textsc{English} \ \& \ \forall w'' \in \textsc{English}[w' \leq_w w'']\}$

(5) (1) is true in w_0 iff $\mathsf{closest}_{\leq_{w_0}}(\textsc{English}) \subseteq \textsc{Dean}$

Ingredient 2: an existential semantics for disjunction.

(6) $[\![\text{Prof. English or Prof. French presented}]\!] = \textsc{English} \cup \textsc{French}$

Not a happy combination

(7) If Prof. English or Prof. French had presented, the Dean would have been happy.

Let us assume that the worlds where Prof. French presents are more distant from the actual world than the worlds where Prof. English presents.

The natural interpretation of (7) commits us to (8-a) and (8-b):

(8) a. If Prof. English had presented, the Dean would have been happy.
b. If Prof. French had presented, the Dean would have been happy.

(9) (7) is true in w_0 iff $\text{closest}_{\leq_{w_0}}(\textsc{English} \cup \textsc{French}) \subseteq \textsc{Dean}$

Given our assumptions, $\text{closest}_{\leq_{w_0}}(\textsc{English} \cup \textsc{French}) = \text{closest}_{\leq_{w_0}}(\textsc{English})$

(10) (7) is predicted to be true in w_0 iff $\text{closest}_{\leq_{w_0}}(\textsc{English}) \subseteq \textsc{Dean}$

Not just disjunction

(11) If a professor in the Modern Languages Dept. had presented, the Dean would have been happy.

(12) $[\![$professor in the Modern Languages Department$]\!] = \{$Prof. English, Prof. French$\}$

(13) a. If Prof. English had presented, the Dean would have been happy.
b. If Prof. French had presented, the Dean would have been happy.

(14) $[\![$ a professor in the Modern Languages Department had presented $]\!] = \textsc{English} \cup \textsc{French}$

This presents the same problem as above.

Santorio's paper presents a number of cases that move beyond disjunctions and indefinites.

2.2 A strategy

Disjunctive and existential antecedents (and possibly other cases discussed by Santorio) lump together the different ways in which the antecedent can be true.

Let the superlative component introduced by counterfactuals see each of the ways in which the antecedent can be true.

Step 1: Determine (some of the) ways in which the antecedent is true.

(15) Prof. English or Prof. French presented.

(16) A professor in the Modern Languages department presented.

We can make use of a set of propositional alternatives to specify (some of the) types of worlds in which these propositions are true.

(17) (15), (16) $\rightsquigarrow_{\text{alt}} \{\textsc{English}, \textsc{French}\}$

Step 2: The superlative component applies *pointwise* to each alternative.

(18) If Prof. English or Prof. French had presented, the Dean would have been happy.

(19) If a professor in the Modern Language Department had presented, the Dean would have been happy.

(20) (18) / (19) is true in w_0 iff $\forall p \in \{\textsc{English}, \textsc{French}\}[\mathsf{closest}_{\leq_{w_0}}(p) \subseteq \textsc{Dean}]$

(21) a. If Prof. English had presented, the Dean would have been happy.
b. If Prof. French had presented, the Dean would have been happy.

Lewis' suggestion

> "Perhaps the 'either ... or' ... [here] is a three-place operator. We could define it as follows:
>
> $$\left.\begin{matrix} A \\ B \end{matrix}\right\} \Box\!\!\rightarrow C =^{\mathrm{df}} A \Box\!\!\rightarrow C \ \wedge \ B \Box\!\!\rightarrow C$$
>
> ... The seeming disjunctive antecedent is an illusion of surface structure."
>
> (Lewis 1977, 360)

Step 3. The interpretation predicted originally can surface under certain conditions.

(22) If a professor in the Department of Modern Languages had presented, it would have been Prof. English.

No commitment to the 'simplified' counterfactuals in (23):

(23) a. If Prof. English had presented, the presenter would have been Prof. English.
b. If Prof. French had presented, the presenter would have been Prof. English.

(See McKay and van Inwagen (1977); Nute (1984).)

(24) (22) is true in w_0 iff $\mathsf{closest}_{\leq_{w_0}}(\textsc{English} \cup \textsc{French}) \subseteq \textsc{English}$

We can get this interpretation by lumping together the propositional alternatives.

(25) (22) is true in w_0 iff $\forall p \in \{\bigcup\{\textsc{English}, \textsc{French}\}\}[\mathsf{closest}_{\leq_{w_0}}(p) \subseteq \textsc{English}]$

Choice points

1. How is Step 1 justified? How are the propositional alternatives of the antecedent determined?

2. How is Step 2 justified? What derives the universal force?
3. How is Step 3 justified? What determines the existential force?

Santorio's approach

Regarding Steps 2 and 3.

If-clauses uniformly denote sets of propositional alternatives.

Counterfactuals and other types of conditionals are structurally ambiguous.

Structure 1: No universal quantification over alternatives The consequent can combine directly with a set of propositional alternatives, as in (26).

(26) LF_1: [If Prof. English or Prof. French had presented] [would [the Dean be happy]]

In this case, the interpretation of the consequent lumps together the alternatives and the counterfactual makes a claim about the closest worlds where at least one of the propositions in the antecedent set is true.

(27) (26) is true in w_0 iff $\mathsf{closest}_{\leq_{w_0}}(\bigcup\{\textsc{English}, \textsc{French}\}) \subseteq \textsc{Dean}]$

Structure 2: Universal quantification over the alternatives A distributive operator can optionally combine with the consequent:

(28) LF_2: If Prof. E. or Prof. F. had presented [Dist [would [the Dean be happy]]]

Dist triggers the presupposition that either both counterfactuals in (29) are true or they are both false. [This is motivated by the behavior of counterfactual conditionals embedded in downward entailing environments.]

(29) a. If Prof. E. had presented, the Dean would have been happy.
b. If Prof. F. had presented, the Dean would have been happy.

When the presupposition is satisfied, we get the result of feeding the consequent with each alternative in the antecedent.

(30) If defined for w_0, (28) is true in w_0 iff
$\forall p \in \{\textsc{English}, \textsc{French}\}[\mathsf{closest}_{\leq_{w_0}}(\bigcup\{p\}) \subseteq \textsc{Happy}]$

Some questions. These assumptions raise some interesting questions. For instance:

- Is this presupposition detectable?
- Is the ambiguity justified? Are the two readings equally accessible? If not, why not?

What about Step 1? Instead of focusing on these questions, we are going to focus on the way Santorio's approach determines the propositional alternatives that the interpretation of the consequent is sensitive to.

Roadmap

1. Illustrate Santorio's algorithm for the determination of the alternatives.
2. Probe into its predictions for a particular case where disjunction, or an indefinite, in object position has narrow scope with respect to a universal quantifier.

3 Illustration of the truthmaker computation algorithm

(31) If Prof. English had given a presentation on a novel, he would have got $100.

3.1 A scenario

(32) *Some facts (that the Dean is aware of.)* Prof. English is lazy. He has presented many times on *Ulysses*. If he were to give a presentation on a novel, he would give a presentation on *Ulysses*. For him to give a presentation on *Mme. Bovary*, he would have to acquire the relevant background knowledge and work for months. That would never happen.

(33) *The Prize.* A victim of his character, Prof. English never participates in any of the Open House Day events. As an incentive, this year the Dean offered him $100 if he gives a presentation on a novel to the prospective students who attend the Open House Day events. The Open House Day runs on a very tight schedule. There is only time for one presentation per professor. The Dean places no conditions on her offer: as long as Prof. English makes a presentation on a novel, he gets the money.

When the time comes, Prof. English does not show up at the Open House Day events. The Dean utters (34) in regret:

(34) What a pity! If Prof. English had given a presentation on a novel, he would have got $100.

(35) $[\![\text{novel}]\!] = \{\textit{Ulysses}, \textit{Mme. Bovary}\}$

Types of worlds envisioned by the Dean for her prize:

(36)

w_1	Prof. English – *Ulysses*
w_2	Prof. English – *Mme. Bovary*

3.2 The algorithm

Step 1. Syntactic alternatives.

Determine from a syntactic object (the Inflectional Phrase (IP)) embedded in the antecedent, a set of competing IPs by simplifying structure or replacing certain items with elements in a set of contrasting items (Katzir, 2007)

Motivation: this algorithm is assumed to be at work in other cases where propositional alternatives are required, like when computing scalar implicatures.

(37) $[_{IP}$ Prof. English had given a presentation on a novel.$]$

Assume that the members of the substitution source for *a novel* are the names of the contextually relevant novels.

(38) $$(37) \rightsquigarrow_{\text{syntactic alts}} \left\{ \begin{array}{c} [_{IP} \text{ Prof. English had given a presentation on a novel}], \\ [_{IP} \text{ Prof. English had given a presentation on } \textit{Ulysses}], \\ [_{IP} \text{ Prof. English had given a presentation on } \textit{Mme. Bovary}] \end{array} \right\}$$

Step 2. Determining truthmakers.

A semantic algorithm determines, on the basis of this set of alternatives, the alternatives that the consequent sees, the *truthmakers*. The *truthmakers* are propositions determined by the *minimal specific subsets* of the syntactic alternatives.

Step 2.1. Specific subsets We now switch to considering the propositions expressed by the syntactic alternatives.

2.1.1. Subsets

(39) $$\left\{ \begin{array}{cccc} \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{U}, \\ \text{Mb} \end{array} \right\}, & \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{U} \end{array} \right\}, & \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{Mb} \end{array} \right\}, & \left\{ \begin{array}{c} \text{U}, \\ \text{Mb} \end{array} \right\}, \\ \{\text{U or Mb}\}, & \{\text{U}\}, & \{\text{Mb}\}, & \emptyset \end{array} \right\}$$

U or Mb := that Prof. English gives a presentation on *Ulysses* or *Mme. Bovary*
U := that Prof. English gives a presentation on *Ulysses*
Mb := that Prof. English gives a presentation on *Mme. Bovary*

2.1.2. *Specific subsets* We select from these the *specific* subsets, where

(40) A subset of alternatives S is specific if S is consistent with the negation of every alternative that is not a member of S.

Specific subsets are closed under weaker alternatives

(41) Not specific:
a. $\{\text{U}, \text{Mb}\}$ (since $\{\text{U}, \text{Mb}\} \cup \{\neg(\text{U or Mb})\}$ is not consistent)
b. $\{\text{U}\}$ (since $\{\text{U}\} \cup \{\neg(\text{U or Mb}), \neg\text{Mb}\}$ is not consistent)
c. $\{\text{Mb}\}$ (since $\{\text{Mb}\} \cup \{\neg(\text{U or Mb}), \neg\text{U}\}$ is not consistent)
d. $\emptyset$ (since $\{\neg(\text{U or Mb}), \neg\text{Mb}, \neg\text{U}\}$ is not consistent)

And S is not specific if a $p \in S$ entails that at least one alternative not in S is true:

(42) Not specific:
$\{\text{U or Mb}\}$ (since U or Mb entails that at least one proposition in { U, Mb } is true, so $\{\text{U or Mb}\} \cup \{\neg\text{U}, \neg\text{Mb}\}$ is inconsistent.

Consistent subsets of alternatives:

(43) $$\left\{ \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{U}, \\ \text{Mb} \end{array} \right\}, \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{U} \end{array} \right\}, \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{Mb} \end{array} \right\} \right\}$$

2.1.3. Minimality

(44) S is a minimally specific subset iff S is specific and S is not a proper superset of any specific subset.

(45) $$\left\{ \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{U} \end{array} \right\}, \left\{ \begin{array}{c} \text{U or Mb}, \\ \text{Mb} \end{array} \right\} \right\}$$

2.1.4. Conjoin alternatives

(46) a. $\bigcap \left\{ \begin{array}{c} \text{U or Mb,} \\ \text{U} \end{array} \right\} = \text{U}$ b. $\bigcap \left\{ \begin{array}{c} \text{U or Mb,} \\ \text{Mb} \end{array} \right\} = \text{Mb}$

2.1.5. Truthmakers

(47) $\{\text{U}, \text{Mb}\}$

2.1.6. Using the truthmakers

2.1.6.1. Quantifying over them

(48) If Prof. English had given a presentation on a novel, the department would have got $1000.

(49) LF_1:
If Eng. had given a presentation on a novel Dist [would [he have got $100]]

(50) (49) is defined iff either the Dean would have given the prize if English had presented on *Ulysses* and also if he had presented on *Mme. Bovary* or if she had not given him a prize in either case.

(51) When defined,(49) is true in w_0 iff $\forall p \in \{\text{U}, \text{Mb}\}, \text{closest}_{\leq_{w_0}}(p) \subseteq \$100$

The two types of worlds that the Dean envisioned for her prize are covered:

(52)

w_1	Prof. English – *Ulysses*
w_2	Prof. English – *Mme. Bovary*

2.1.6.2. Lumping the truthmakers together

(53) LF_2:
If Prof. Eng. had made a presentation on a novel [would [he have got $100]]

(54) (49) is true in w_0 iff $\text{closest}_{\leq_{w_0}}(\bigcup\{\text{U}, \text{Mb}\},) \subseteq \$100$

This seems to be what we get when simplification would have have given rise to a contradiction.

(55) If Prof. English had made a presentation on a novel, he would have made a presentation on *Ulysses*.

4 Enough Truthmakers?

4.1 Target case: Existentials under a universal

(56) If **every professor in the Department of Modern Languages** had given a presentation on **a novel**, the Department would have got the \$1000 prize.

(57) *Some facts (that the Dean is aware of.)* The faculty members in the Department of Modern Languages (Prof. English and Prof. French) are lazy. Prof. English has presented many times on *Ulysses*. If he were to give a presentation on a novel, he would give a presentation on *Ulysses*. For him to give a presentation on *Mme. Bovary*, he would have to acquire the relevant background knowledge and work for months. Likewise for Prof. French. If he were to give a presentation, he would give one on *Mme. Bovary*.

(58) *The Prize.* The Department of Modern Languages never participates in any of the Open House Day events. As an incentive, this year the Dean offered the department \$1000 if every professor gives a presentation on a novel to the prospective students who attend the Open House Day events. The Open House Days runs on a very tight schedule. There is only time for one presentation per professor. The Dean places no conditions on her offer: as long as all the professors make a presentation on a novel, the department gets the money.

As expected, nobody from the Department of Modern Languages showed up at the Open House. The Dean utters (59) in regret.

(59) What a pity! If **every professor in the Department of Modern Languages** had given a presentation on **a novel**, the Department would have got the \$1000 prize.

(60) a. $[\![$professor in the Modern Languages Department$]\!] = \{$Prof. English, Prof. French$\}$
b. $[\![$novel$]\!] = \{$*Ulysses*, *Mme. Bovary*$\}$

Types of worlds envisioned by the Dean for her prize:

(61)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*
w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*
w_4	Prof. English – *Mme. Bovary*	&	Prof. French – *Ulysses*

Closest worlds amongst those envisioned by the Dean, given the facts above:

(62)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*
w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*
w_4	Prof. English – *Mme. Bovary*	&	Prof. French – *Ulysses*

4.2 Determining the truth-makers

Step 1: syntactic alternatives.

(63) a. Substitution set for *every*: { *every*, *some* }
 b. Substitution set for *a novel*: { *Ulysses*, *Mme. Bovary*}

(64) [$_{IP}$ Every professor in the Department of Modern Languages gives a presentation on a novel.]

(65) (64) $\rightsquigarrow_{\text{syn. alt.}}$ {
[$_{IP}$Every professor gives a presentation on *Ulysses* or *Mme. Bovary*],
[$_{IP}$Some professor gives a presentation on *Ulysses* or *Mme. Bovary*],
[$_{IP}$Every professor gives a presentation on *Ulysses*],
[$_{IP}$Some professor gives a presentation on *Ulysses*],
[$_{IP}$Every professor gives a presentation on *Mme. Bovary*],
[$_{IP}$Some professor gives a presentation on *Mme. Bovary*]
}

Step 2. Determining the truthmakers.

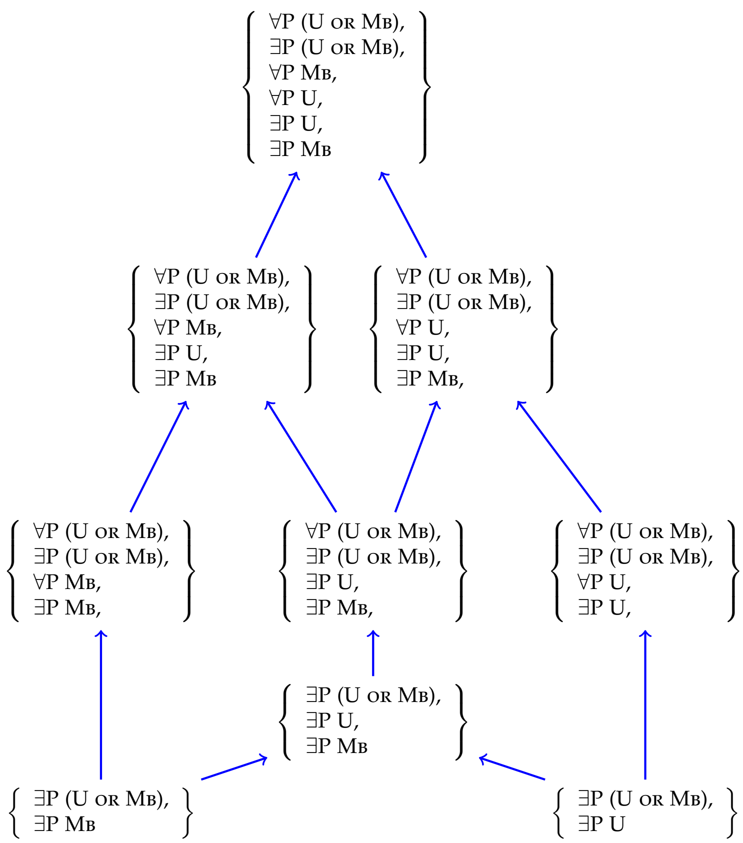
Step 2.1. Subsets of alternatives. We now get a very large set search space, since $|\wp(65)| = 2^6 = 64$.

(66)

$\emptyset$	$\{\forall P\,(U \text{ or } MB)\}$	$\{\exists P\,(U \text{ or } MB)\}$	$\{\forall P\,U\}$	$\{\forall P\,MB\}$	$\{\exists P\,U\}$	$\{\exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB)\}$
$\{\forall P\,(U \text{ or } MB), \forall P\,U\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \exists P\,U\}$	$\{\exists P\,(U \text{ or } MB), \exists P\,MB\}$
$\{\forall P\,U, \forall P\,MB\}$	$\{\forall P\,U, \exists P\,U\}$	$\{\forall P\,U, \exists P\,MB\}$	$\{\forall P\,MB, \exists P\,U\}$	$\{\forall P\,MB, \exists P\,MB\}$	$\{\exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,MB\}$
$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,MB, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,U, \exists P\,MB\}$
$\{\exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,U\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \exists P\,U, \exists P\,MB\}$	$\{\forall P\,U, \forall P\,MB, \exists P\,U\}$	$\{\forall P\,U, \forall P\,MB, \exists P\,MB\}$
$\{\forall P\,U, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \exists P\,U, \exists P\,MB\}$
$\{\forall P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,U, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U, \exists P\,MB\}$
$\{\forall P\,U, \forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U, \exists P\,MB\}$	$\{\forall P\,(U \text{ or } MB), \exists P\,(U \text{ or } MB), \forall P\,U, \forall P\,MB, \exists P\,U, \exists P\,MB\}$

Step 2.2. Determining the specific subsets. Of all 64 subsets, only 9 are specific. These 9 specific subsets are shown below, together with the ordering determined by the (proper) subset relation:

(67)



Step 2.3. Determining the *minimal* specific subsets. The minimal specific subsets are the ones at the bottom of the previous diagram.

Step 2.4. Truthmakers. Conjoining the propositions in the minimal specific subsets, we end up with

(68) $\{\exists \text{P U}, \exists \text{P M}\textsc{b}\}$

But these propositions don't entail the proposition expressed by the antecedent, in (69)

(69) $\forall$P (U or Mb)

Consequence 1

Because we allow the algorithm to take into consideration the weaker scalemates induced by the subject, minimality needs to be determined with respect to the candidates that include the proposition expressed by the antecedent.

We end up with:

$$(70)\quad \left\{ \left\{ \begin{array}{l} \forall\text{P (U or Mb)}, \\ \exists\text{P (U or Mb)}, \\ \forall\text{P Mb}, \\ \exists\text{P Mb}, \end{array} \right\}, \left\{ \begin{array}{l} \forall\text{P (U or Mb)}, \\ \exists\text{P (U or Mb)}, \\ \exists\text{P U}, \\ \exists\text{P Mb}, \end{array} \right\}, \left\{ \begin{array}{l} \forall\text{P (U or Mb)}, \\ \exists\text{P (U or Mb)}, \\ \forall\text{P U}, \\ \exists\text{P U}, \end{array} \right\} \right\}$$

Conjoining the propositions in each subset:

(71) $\{\forall\text{P Mb}, [\forall\text{P (U or Mb)} \;\&\; \exists\text{P U} \;\&\; \exists\text{P Mb}], \forall\text{P U}\}$

Consequence 2: Enough truthmakers?

In the absence of DIST

(72) LF_1:
If every prof. had given a presentation on a novel [would [DML have got 1K]]

Given our background assumptions,

$$(73)\quad \text{closest}_{\leq_{w_0}} \left(\bigcup \left\{ \begin{array}{c} \forall\text{P U}, \\ \forall\text{P (U or Mb)} \;\&\; \exists\text{P U} \;\&\; \exists\text{P Mb}, \\ \forall\text{P Mb} \end{array} \right\} \right) =$$
$$\text{closest}_{\leq_{w_0}} \left(\left\{ w \,\middle|\, \begin{array}{l} \text{Prof. English gives a presentation on } \textit{Ulysses} \text{ in } w \text{ and} \\ \text{Prof. French gives a presentation on } \textit{Mme. Bovary} \text{ in } w \end{array} \right\} \right)$$

Types of worlds that the conditional makes a claim about.

(74)

w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*

Perhaps OK in the cases where Simplification seems to be blocked:

(75) If every professor had given a presentation on a novel, Prof. English would have talked about *Ulyses* and Prof. French about *Mme. Bovary*.

But this interpretation is too weak to cover the types of worlds that the Dean considered for her prize:

(76)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*
w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*
w_4	Prof. English – *Mme. Bovary*	&	Prof. French – *Ulysses*

DIST strengthens the meaning. . . but not enough

(77) LF$_2$:
If every prof. had given a presentation on a novel DIST [would [DML gets 1K]]

(Disregarding from now the presupposition triggered by DIST):

(78) (77) is true in w_0 iff

$$\forall p \in \left\{ \begin{array}{c} \forall \text{P U}, \\ \forall \text{P (U } \textsc{or} \text{ Mb) \& } \exists \text{P U \& } \exists \text{P Mb}, \\ \forall \text{P Mb} \end{array} \right\} [\mathsf{closest}_{\leq_{w_0}}(p) \subseteq \textsc{Prize}]$$

Given our background assumptions,

(79) $\mathsf{closest}_{\leq_{w_0}}(\forall \text{P (U } \textsc{or} \text{ Mb) \& } \exists \text{P U \& } \exists \text{P Mb}) =$

$$\mathsf{closest}_{\leq_{w_0}}\left(\left\{ w \,\middle|\, \begin{array}{l} \text{Prof. English gives a presentation on } \textit{Ulysses} \text{ in } w \text{ and} \\ \text{Prof. French gives a presentation on } \textit{Mme. Bovary} \text{ in } w \end{array} \right\} \right)$$

Types of worlds that the conditional makes a claim about:

(80)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*
w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*

Types of worlds missing:

(81)

w_4	Prof. English – *Mme. Bovary*	&	Prof. French – *Ulysses*

5 To conclude

5.1 Summing-up

If we only had the alternatives introduced by the existential, we would not generate enough truthmakers.

(82) $\{\forall \text{P U}, \forall \text{P Mb}\}$

(83)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*

The analysis that I presented in previous work delivered these alternatives by default (as a result of disjunction introducing a set of alternatives grow propositional by pointwise functional application.) Optionally, it can also deliver one alternative, the one in (84), which corresponds to a narrow scope interpretation of the existential (as a result of quantifying existentially over the alternatives introduced by disjunction.)

(84) $\{\forall$P (U OR MB)$\}$

Neither of these two possibilities is enough. Introducing the scale mates of *every* into the candidates that generate the truthmakers gives us more truth-makers. That is a nice result. But there are are still not enough truthmakers.

5.2 What do we need?

One way to make more truthmakers available would be to throw into the pragmatic competitors the results of restricting the domain of quantification of the universal.

(85) Every professor gives a presentation on a novel.

Step 1: syntactic alternatives

(86) a. Substitution set for *every professor in D*: { *every*, *some*, *Prof. Eng*, *Prof. French* }
b. Substitution set for *a novel*: { *Ulysses*, *Mme. Bovary*}

(87) $\left\{\begin{array}{l}\text{Every professor gives a presentation on } \textit{Ulysses} \text{ or } \textit{Mme. Bovary}, \\ \text{Some professor gives a presentation on } \textit{Ulysses} \text{ or } \textit{Mme. Bovary}, \\ \text{Every professor gives a presentation on } \textit{Ulysses}, \\ \text{Some professor gives a presentation on } \textit{Ulysses}, \\ \text{Every professor gives a presentation on } \textit{Mme. Bovary}, \\ \text{Some professor gives a presentation on } \textit{Mme. Bovary}, \\ \text{Prof. English gives a presentation on } \textit{Ulysses} \text{ or } \textit{Mme. Bovary}, \\ \text{Prof. French gives a presentation on } \textit{Ulysses} \text{ or } \textit{Mme. Bovary}, \\ \text{Prof. English gives a presentation on } \textit{Ulysses}, \\ \text{Prof. French gives a presentation on } \textit{Ulysses}, \\ \text{Prof. English gives a presentation on } \textit{Mme. Bovary}, \\ \text{Prof. French gives a presentation on } \textit{Mme. Bovary},\end{array}\right\}$

Step 2. Determining the truthmakers. The space search to determine the specific subsets would now be really big ($|\wp((87))| = 2^{12}$).

But now we would get more specific subsets:

(88)
$$\left\{\begin{array}{l}\left\{\begin{array}{l}\forall\text{P (U or Mb)},\\ \exists\text{P (U or Mb)},\\ \forall\text{P U},\\ \exists\text{P U},\\ \text{Eng (U or Mb)},\\ \text{Fr (U or Mb)},\\ \text{Eng U},\\ \text{Fr U}\end{array}\right\},\left\{\begin{array}{l}\forall\text{P (U or Mb)},\\ \exists\text{P (U or Mb)},\\ \forall\text{P Mb},\\ \exists\text{P Mb},\\ \text{Eng (U or Mb)},\\ \text{Fr (U or Mb)},\\ \text{Eng Mb},\\ \text{Fr Mb}\end{array}\right\}\\ \left\{\begin{array}{l}\forall\text{P (U or Mb)},\\ \exists\text{P (U or Mb)},\\ \exists\text{P U},\\ \exists\text{P Mb},\\ \text{Eng (U or Mb)},\\ \text{Fr (U or Mb)},\\ \text{Eng U},\\ \text{Fr Mb}\end{array}\right\},\left\{\begin{array}{l}\forall\text{P (U or Mb)},\\ \exists\text{P (U or Mb)},\\ \exists\text{P U},\\ \exists\text{P Mb},\\ \text{Eng (U or Mb)},\\ \text{Fr (U or Mb)},\\ \text{Eng Mb},\\ \text{Fr U}\end{array}\right\}\end{array}\right\}$$

And we would get the set of truthmakers in (89):

(89)
$$\left\{\begin{array}{c}\text{Eng U \& Fr U},\\ \text{Eng U \& Fr Mb},\\ \text{Eng Mb \& Fr U},\\ \text{Eng Mb \& Fr Mb}\end{array}\right\}$$

This would make sure that the counterfactual considers worlds where Prof. English reads *Mme. Bovary* and Prof. French reads Ulysses.

(90)

w_1	Prof. English – *Ulysses*	&	Prof. French – *Ulysses*
w_2	Prof. English – *Mme. Bovary*	&	Prof. French – *Mme. Bovary*
w_3	Prof. English – *Ulysses*	&	Prof. French – *Mme. Bovary*
w_4	Prof. English – *Mme. Bovary*	&	Prof. French – *Ulysses*

A question

One can read Santorio's proposal as claiming that the determination of the propositional alternatives that counterfactuals are sensitive to is parasitic on the mechanisms that determine the propositional alternatives required to derive scalar implicatures.

Do we see the domain alternatives required above in other cases of scalar reasoning? We don't in positive environments, since they are entailed by the assertion:

(91) a. Cookie monster ate every cookie in that jar.
b. $\Rightarrow$ Cookie monster ate some of the cookies in that jar.
c. $\Rightarrow$ Cookie monster ate cookie 1, Cookie monster ate cookie 2, ...

In negative environments, the domain alternatives asymetrically entail the assertion:

(92) a. Cookie monster didn't eat every cookie in that jar.
b. $\Leftarrow$ Cookie monster didn't eat at least one of the cookies in that jar.
c. $\Leftarrow$ Cookie monster didn't eat cookie 1, Cookie monster didn't eat cookie 2, ...

But the domain alternatives do not seem to trigger implicatures they way the scalar implicatures do. The *some*-alternative corresponds to the implicature that Cookie monster ate some of the cookies.

(93) a. Cookie monster didn't eat every cookie in that jar.
b. $\rightsquigarrow \Box_{sp}\neg$[Cookie monster didn't eat at least one of the cookies in that jar]
($\rightsquigarrow \Box_{sp}$ Cookie monster ate some of the cookies in that jar.)

The implicature that the speaker is convinced that Cookie Monster ate cookie 1 & that Cookie Monster ate cookie 2 ... (for all cookies in the domain) would contradict the assertion.

(94) a. Cookie monster didn't eat every cookie in that jar.
b. $\rightsquigarrow \Box_{sp}\neg$[Cookie monster didn't eat cookie n]
($\rightsquigarrow \Box_{sp}$ Cookie monster ate cookie n.)

The weaker implicature that the speaker is *not* convinced that Cookie Monster ate cookie 1 & that she is not convinced that Cookie Monster ate cookie 2 ... (for all cookies in the domain) would be consistent with the assertion.

(95) a. Cookie monster didn't eat every cookie in that jar.
b. $\rightsquigarrow \neg\Box_{sp}$[Cookie monster didn't eat cookie 1, ...]

(96)

w_1	CM ate c_1	CM didn't eat c_2
w_2	CM didn't eat c_1	CM ate c_2

But that would give us more ignorance than attested.

(97) Cookie monster didn't eat every cookie in that jar: he didn't eat that one over there.

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