Alternatives in the Disjunctive Antecedents Problem

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1. The problem

Consider the following scenario: the summer is over and you and I are visiting a farm. The owner of the farm is complaining about last summer's weather. To give us an example of its devastating effects, he points to the site where he used to grow huge pumpkins: there is a bunch of immature pumpkins and many ruined pumpkin plants. He then utters the counterfactual in (1):

(1) If we had had good weather this summer or the sun had grown cold, we would have had a bumper crop. (A variation on an example in Nute 1975)

We conclude, right then, that there is something strange about this farmer. We have a strong intuition that the counterfactual in (1) is false: if we had had good weather this summer, he would have had a good crop, but we know for a fact — and we assume that the farmer does too — that if the sun had grown cold, the pumpkins, much as everything else, would have been ruined.

The problem that this paper deals with is that, under standard assumptions about the semantics of *or*, a minimal change semantics for counterfactuals (Stalnaker, 1968; Stalnaker and Thomason, 1970; Lewis, 1973) predicts (1) to be true, contrary to intuitions.

To see why this is so, we need to adopt a simple minimal change semantics for counterfactuals. In a minimal change semantics, evaluating whether a counterfactual is true involves checking whether the consequent is true in the world(s) in which the antecedent is true that are as close as possible to the actual world. We will assume here that *would* counterfactuals are true in the actual world if and only if the consequent is true in *all* the worlds where the antecedent is true that differ as little as possible from the actual world.

To state these truth conditions formally, we will take the interpretation of counterfactuals to be relative to a relation of comparative similarity defined for the set of accessible worlds W (which, we will assume, is the set of all possible worlds). Following Lewis (1973, p. 48), we will take any admissible relation of comparative similarity $\leq_w$ to be a weak ordering of W, with the world w alone at the bottom of the ordering (w is more similar to w than any other world w'). We will also make what Lewis calls the 'Limit Assumption': for any world w and set of worlds W we assume that there is always at least one world w' in W that comes closest to w. Under these assumptions, the semantics of *would* counterfactuals can be formalized by means of a class selection function f that picks up for any world of evaluation w, any admissible relation of comparative similarity $\leq_w$, and any proposition p, the worlds where p is true that come closest to w:

(2) For any proposition p, worlds w, w', and any relation of relative similarity $\leq$,
$f_{\leq_w}(p)(w') \leftrightarrow [p(w')\ \&\ \forall w''[p(w'') \rightarrow w' \leq_w w'']]$

We can now state the truth conditions of *would* counterfactuals as follows: a *would* counterfactual is true in a world w (with respect to an admissible ordering) if and only if all worlds picked up by the class selection function (all the closest worlds to w in which the antecedent is true) are worlds in which the consequent is true.

(3) $[\![\text{If } \phi, \text{then would } \psi]\!]^{\leq}(w) \Leftrightarrow \forall w'[f_{\leq_w}([\![\phi]\!])(w') \rightarrow [\![\psi]\!](w')]$

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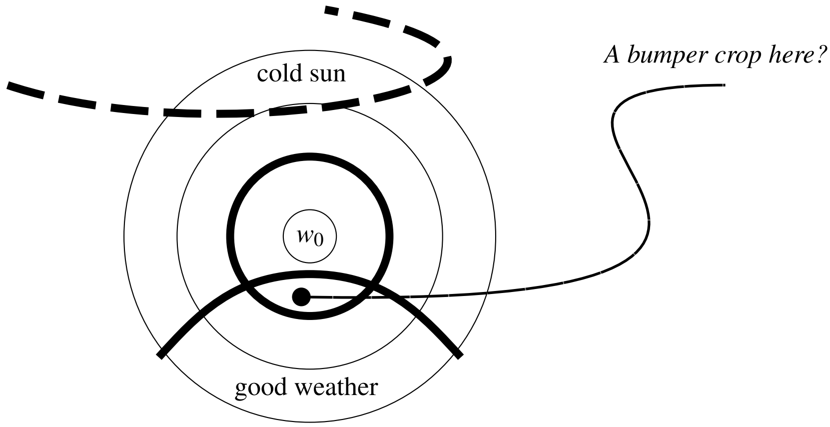


Figure 1: The problem of disjunctive antecedents.

Consider again the counterfactual in (1). Under the standard Boolean semantics of *or*,the proposition expressed by the antecedent of (1) is the union of the set of worlds where the summer weather was good and the set of worlds where the sun grows cold:[1]

(4) $[\![$If we had had good weather this summer or the sun had grown cold$]\!]$
$= \lambda w.\mathbf{good\text{-}weather}_w \vee \mathbf{grow\text{-}cold}_w(\mathbf{s})$

According to the semantics in (3), then, the counterfactual in (1) is predicted to be true in the actual world with respect to an admissible ordering of worlds if and only if the closest worlds in the ordering where the proposition in (4) is true are all worlds where we have a bumper crop.

The problem is that these truth conditions are too weak. In the scenario we started the discussion with, the counterfactual in (1) is evaluated with respect to an intuitive notion of relative similarity according to which the possible worlds where the sun grows cold are more remote from the actual world than the possible worlds where we have a good summer (more actual facts have to be false in a world where the sun grows cold than in a world where we have good summer weather). This similarity relation is represented in Fig. 1, where each circle represents a set of worlds that are equally close to the actual world, the dotted line surrounds the worlds where the sun gets cold, and the solid line the worlds where there is good weather this summer. With respect to this relation of comparative similarity, none of the worlds in which the proposition in (4) is true where the sun grows cold can count closer to the actual world than the worlds where we have a good summer. The selection function, therefore, only returns worlds where we have a good summer. Since in all the closest worlds where we have a good summer it is true that we have a bumper crop, the counterfactual in (1) is predicted to be true, contrary to our initial intuition.

The problem was first pointed out in the philosophical literature in the mid-seventies as an argument against Lewis' minimal change semantics for counterfactuals (Lewis, 1973).[2] There have been many reactions to it since then (Nute and Cross 2001 for an overview). For some researchers, the problem justifies abandoning a minimal change semantics for counterfactuals altogether: Ellis *et al.* (1977), for instance, proposed abandoning a possible world semantics for subjunctive conditionals, Warmbrōd (1981) advocates adopting a context-dependent downward monotonic semantics, and, most recently, Herburger and Mauck (2007) propose developing an event-based semantics. There might be reasons to abandon a minimal change semantics for counterfactuals, but the goal of this paper is to show, as van Rooij (2006) does, that the failure to capture the natural interpretation of disjunctive counterfactuals need not be one. We will see that the natural interpretation of disjunctive counterfactuals is in fact expected,

[1] I make use of a two-typed language in the metalanguage Gallin (1975). World arguments are subscripted. For the purposes of illustration, I take **good-weather** to be a predicate of worlds. The contribution of tense and mood is ignored. I will omit the superscript indicating that the interpretation function is relative to a relative similarity ordering when the ordering bears no effect on the interpretation.

[2] See, among others, Creary and Hill (1975), Nute (1975), Fine (1975), and Ellis *et al.* (1977).

even within a minimal change semantics, once we refine our assumptions about the semantics of *or* and the logical form of conditionals.

2. The analysis

The analysis of counterfactuals with disjunctive antecedents that we will entertain makes two novel assumptions: the first has to do with the semantics of disjunction, and the second with the logical form of conditionals. In the illustration of the problem in section 1, we have taken for granted the standard Boolean semantics for *or*. In line with recent work on the semantics of natural language disjunction (Aloni, 2003; Simons, 2005; Alonso-Ovalle, 2006), we will assume, instead, that *or* introduces into the semantic derivation a set of propositional alternatives. We will then adopt a compositional analysis of conditionals that assumes that they are correlative constructions. The natural interpretation of disjunctive counterfactuals is shown to follow from these two assumptions.

2.1. Disjunctive antecedents in an alternative semantics

The analysis will be cast in a Hamblin-style semantics. In a Hamblin semantics, expressions of type τ are mapped to sets of objects in D_τ. Most lexical items denote singletons containing their standard denotations: the proper name in (5a) is mapped to a singleton containing an individual, and the verbs in (5b-5c) are mapped to a singleton containing a property, for instance. We will assume, however, that disjunctions denote sets containing more than one semantic object: as stated in (5d), *or* simply gathers in a set the denotation of the expressions that it operates over.[3]

(5) a. $[\![\text{Sandy}]\!] = \{\mathbf{s}\}$
   b. $[\![\text{sleep}]\!] = \{\lambda x.\lambda w.\mathbf{sleep}_w(x)\}$
   c. $[\![\text{see}]\!] = \{\lambda y.\lambda x.\lambda w.\mathbf{see}_w(x,y)\}$
   d. *The* Or *Rule*
   Where $[\![\phi]\!], [\![\psi]\!] \subseteq \mathrm{D}_\tau$, $\left[\!\!\left[[_{\xi}\ \phi\ \text{or}\ \psi\ ] \right]\!\!\right] \subseteq \mathrm{D}_\tau = [\![\phi]\!] \cup [\![\psi]\!]$

We will only be concerned for the most part with the way expressions combine by functional application. In an alternative semantics, functional application is defined pointwise, as in (6) below: to combine a pair of expressions denoting a set of objects of type $\langle\sigma,\tau\rangle$ and a set of objects of type σ, every object of type $\langle\sigma,\tau\rangle$ applies to every object of type σ, and the outputs are collected in a set.

(6) *The Hamblin Rule*
   If $[\![\alpha]\!] \subseteq D_{\langle\sigma,\tau\rangle}$ and $[\![\beta]\!] \subseteq D_\sigma$, then $[\![\alpha(\beta)]\!] = \{\ c \in D_\tau \mid \exists a \in [\![\alpha]\!] \exists b \in [\![\beta]\!] (c = a(b))\ \}$
   (Hamblin, 1973)

With these assumptions in mind, let us consider again the disjunctive counterfactual in (1), repeated in (7) below:

(7) If we had had good weather this summer or the sun had grown cold, we would have had a bumper crop. (A variation on an example in Nute 1975)

We will assume, as before, that the disjunction within the antecedent operates over two propositions. The relevant interpretable structure of the disjunction within the *if*-clause is the one in (8) below:

(8) $[_{\mathrm{IP}_1}\ [_{\mathrm{IP}_2}\ \text{we had had good weather this summer}]\ \text{or}\ [_{\mathrm{IP}_3}\ \text{the sun had grown cold}]\ ]$

[3] In what follows, we will represent the internal structure of disjunctions at LF as flat. It is inmaterial for the present analysis whether it is, but the reader is referred to Munn (1993) and den Dikken (2006), where the internal structure of disjunctive constituents is assumed *not* to be flat.

In the discussion of the example in section 1, we took for granted the textbook semantics for *or*, under which IP_1 denotes a proposition (the set of worlds in which at least one of the disjuncts is true). We will now drop that assumption. In the Hamblin-style semantics that we are assuming, IP_1 denotes a set of propositions. In (8), *or* operates over the denotation of IP_2 and IP_3: IP_2 denotes the singleton containing the proposition that we have good weather this summer, and IP_3 the singleton containing the proposition that the sun grows cold; IP_1 denotes, therefore, the union of these two sets: the set containing the proposition that we have good weather this summer and the proposition that the sun grows cold, as illustrated below.

(9) a. $[\![IP_2]\!] = \{\lambda w.\mathbf{good\text{-}weather}_w\}$, $[\![IP_3]\!] = \{\lambda w.\mathbf{grow\text{-}cold}_w(\mathbf{s})\}$

b. $[\![IP_1]\!] = [\![IP_2]\!] \cup [\![IP_3]\!] = \left\{ \begin{array}{c} \lambda w.\mathbf{good\text{-}weather}_w, \\ \lambda w.\mathbf{grows\text{-}cold}_w(\mathbf{s}) \end{array} \right\}$

The interpretation of disjunctive counterfactuals discussed in section 1 involves checking whether the consequent holds in the closest worlds in each disjunct. To capture this interpretation, the selection function needs to apply to each disjunct on its own. If we assume the standard semantics for *or*, the selection function can only see the proposition that the whole disjunction denotes. That causes the problem. Under the present setup, however, the denotation of the disjuncts can be easily retrieved from the denotation of the whole disjunction, and, therefore, in principle, the selection function can now access each disjunct on its own. By assuming that *or* introduces a set of propositions into the semantic derivation, we allow for the semantic composition of counterfactuals to make reference to the closest worlds in each disjunct. But to see how exactly the closest worlds in each of the disjuncts are selected, we need to say something about the logical form of conditionals. We will see in the next section that a natural answer emerges once we assume that conditionals are correlative constructions.

2.2. Conditionals as correlatives

In (10) we have a few well-known examples of Hindi correlatives:

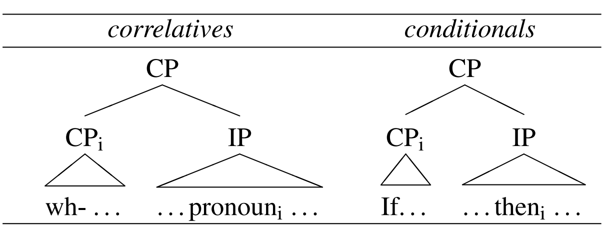
(10) a. [jo laRkii khaRii hai]$_i$ vo$_i$ lambii hai
which girl standing be-present she tall be-present
'Which girl is standing, that one is tall.' (Dayal, 1996, p. 188)

b. [jo laRkiyaaN khaRii haiN]$_i$ ve$_i$ lambii haiN
which girls standing be-present they tall be-present
'Which girls are standing, they are tall.' (Dayal, 1996, p. 192)

c. [jo do laRkiyaaN khaRii haiN]$_i$ ve$_i$ lambii haiN
which two girls standing be-present they tall be-present
'Which two girls are standing, they are tall.' (Dayal, 1996, p. 192)

In a correlative, a relative clause adjoined to the matrix clause provides an anaphoric pronoun inside the main clause with an antecedent, as illustrated in (11) below. We find the same anaphoric relation in a conditional: it is natural to treat *then* as a resumptive pronoun that picks up the denotation of the *if*-clause as its antecedent.

(11)



In line with recent work on the syntax-semantics of conditionals, we will assume that conditionals are correlative constructions (von Fintel, 1994; Izvorski, 1997; Bhatt and Pancheva, 2006; Schlenker, 2004). The analysis that I present next builds on work on the semantics of correlatives by Veneeta Dayal (Srivastav1991a, 1991b, Dayal 1995, 1996). There are two main components to it: (i) the consequent of a conditional is analyzed as denoting a property of propositions, much as the main clause of a correlative denotes a property of individuals (this is possible once *then* is analyzed as a propositional anaphor); and, (ii) *if*-clauses are analyzed as universal quantifiers ranging over propositions, much as antecedents of correlatives universally quantify over individuals.

We will start by assuming, in line with the literature, that *then* is a propositional anaphor (Iatridou 1991a, 1991b, 1994, von Fintel 1994, Hegarty 1996). As other natural language quantifiers do, modals range over a contextually supplied domain of quantification. We will capture this contextual dependency by assuming that they take as an argument a pronoun ranging over propositions (von Fintel, 1994). *Then*, I want to assume, is one such pronoun, which is in complementary distribution with a covert counterpart.[4] Its interpretation, like the interpretation of other pronouns, is provided by the variable assignment: at LF, *then* bears an index; in the type of alternative semantics that I am assuming, *then* denotes a singleton containing the proposition that the variable assignment maps its index to:[5]

(12) $[\![\text{then}_{\langle 7,\langle s,t\rangle\rangle}]\!]^g = \{g(\langle 7,\langle s,t\rangle\rangle)\}$

What is the semantic import of the anaphoric link between the *if*-clause and the pronoun *then* in the main clause? Dayal (1996) assumes that the anaphoric relation between the relative and the pronoun in the main clause is a case of variable binding. The antecedent of a correlative is a generalized quantifier, which takes as an argument the property that results from abstracting over the pronoun in the main clause, as illustrated below with a plural correlative.[6]

(13) a. jo laRkiyaaN khaRii haiN ve lambii haiN
which girls standing be-PR they tall be-PR
'Which girls are standing, they are tall.' (Dayal, 1996, p. 192)

b. IP : $\forall x[(\mathbf{girl}(x)\ \&\ \mathbf{stand}(x)) \rightarrow \mathbf{tall}(x)]$
CP$_\text{i}$: $\lambda P_{\langle e,t\rangle}.\forall x[(\mathbf{girl}(x)\ \&\ \mathbf{stand}(x)) \rightarrow P(x)]$ IP : $\mathbf{tall}(x)$
which girls standing be they$_i$ tall be

Once *then* is analyzed as a propositional anaphor, we can analyze the consequent of a conditional as denoting a property of propositions, much as the consequent of a correlative denotes a property of individuals. Consider again, for instance, the counterfactual that we opened this paper with, repeated in (14) below:

(14) If we had had good weather this summer or the sun had grown cold, (then) we would have had a bumper crop. (A variation on an example in Nute 1975)

We will assume that the interpretable structure of its consequent is as in (15):

(15) IP
$\oplus$ $\otimes$
would then$_{5_{\langle s,t\rangle}}$ we have had a bumper crop

[4] This is a simplification. Schlenker (2004) argues that *then* is really doubling an implicit argument.

[5] A variable assignment is assumed to be a function from pairs of natural numbers and type specifications to entities of the right type. In what follows, I will use a slightly different notation: instead of writing 'then$_{\langle 7,\langle s,t\rangle\rangle}$', I will write 'then$_{7_{\langle s,t\rangle}}$'.

[6] In the illustration in (13b), I simplify a bit for expository reasons. Srivastav (1991, p. 668) assumes that the domain of individuals is closed under sum formation and treats the antecedent of a plural correlative as a universal quantifier whose domain of quantification is the supremum of the set of girls who are standing, as in (i) below. If the predicate abstract with which this quantifier combines is distributive, as in the example in (13b), the resulting truth conditions are equivalent.

(i) $\lambda P_{\langle e,t\rangle}.\forall x[(x = \iota x.({}^*\mathbf{girl}(x)\ \&\ \mathbf{stand}(x)) \rightarrow P(x)]$

See section 3, however, for reasons to assume that we need a universal in the case of disjunctive conditionals.

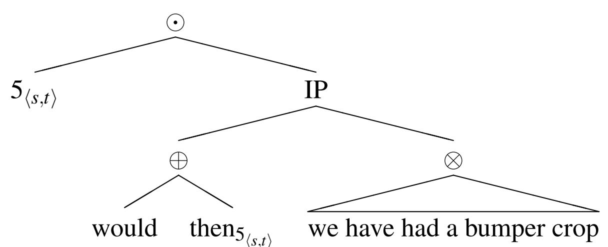
Would is assumed to be a function that takes two propositions p and q as arguments and returns the singleton containing the proposition that is true in a world w if and only if the closest worlds to w where p is true are all worlds where q is true.

(16) $[\![\text{would}]\!]^{\leq,g} = \{\lambda p_{\langle s,t\rangle}.\lambda q_{\langle s,t\rangle}.\lambda w.\forall w'[f_{\leq_w}(p)(w') \rightarrow q(w')]\}$

With respect to any admissible similarity relation $\leq$, the LF in (15) denotes the singleton containing the proposition that is true in a world w if and only if the worlds in the proposition that *then* takes as its antecedent that come closest to w in the relevant ordering are all worlds where we have a bumper crop.

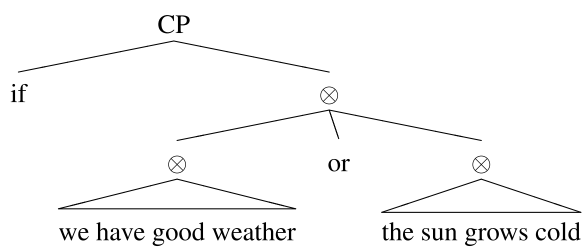
(17) $$[\![(15)]\!]^{\leq,g} = \left\{ \lambda w.\forall w' \left[\begin{array}{c} f_{\leq_w}(\mathrm{g}(5_{\langle s,t\rangle}))(w') \\ \rightarrow \\ \textbf{have-a-bumper-crop}_{w'}(\textbf{we}) \end{array} \right] \right\}$$

By abstracting over *then* in (15), we end up with (a set containing) a function from propositions to propositions that maps any proposition p into the proposition that is true in a world w if and only if the p-worlds that come closest to w are all worlds where we have a bumper crop.[7]

(18) $[\![$  $]\!]^{\leq,g} =$

$$\{\lambda p_{\langle s,t\rangle}.q_{\langle s,t\rangle} \mid q \in [\![(15)]\!]^{\leq,g[p/5_{\langle s,t\rangle}]}\}$$

What is the denotation of the *if*-clause? The antecedent of a correlative denotes, under Dayal's analysis, a generalized quantifier: a property of properties of individuals. The relative in the example in (13b) denotes a property of properties of individuals that holds of any property P if and only if P holds of every individual who is a girl and is standing. Under the Hamblin-style analysis of disjunction that we are assuming, we can treat the *if*-clause in parallel to Dayal's analysis as denoting a property of properties of propositions which holds of any property of propositions $f_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle}$ if and only if $f_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle}$ holds of every proposition in the set of propositional alternatives denoted by the antecedent (a singleton, in the case of non disjunctive antecedents; a set that contains all the atomic propositional disjuncts in the case of disjunctive antecedents). The *if*-clause in (19) denotes, under this analysis, a property of properties of propositions that holds of any property of propositions $f_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle}$ in a world w if and only if $f_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle}$ holds in w of the proposition that we have good weather this summer and of the proposition that the sun grows cold.

(19) $[\![$  $]\!]^{\leq,g}$

$$= \left\{ \lambda f_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle}.\lambda w.\forall p \left[p \in \left\{ \begin{array}{c} \lambda w.\textbf{good-w}_w, \\ \lambda w.\textbf{cold}_w(\textbf{s}) \end{array} \right\} \rightarrow f(p)(w) \right] \right\}$$

The denotation of the whole conditional can be now calculated by applying the denotation of the *if*-clause to the denotation of the consequent.

[7] For ease of exposition, I assume that the lambda abstraction is represented at LF by means of an index, as in Heim and Kratzer (1998). From now on, I will use the expression 'the p-worlds' to refer to the worlds where a certain proposition p is true.

(20) $[\![(14)]\!]^{\leq,g} = [\![(19)]\!]^{\leq,g}([\![(18)]\!]^{\leq,g})$

Under the present analysis, the sentence in (14) denotes, for any admissible ordering, the singleton containing the proposition that is true in a world w if and only if all the closest worlds to w in which we have good weather are worlds where we have a bumper crop, and all the closest worlds to w in which the sun grows cold are worlds where we have a bumper crop. With respect to an ordering that makes every world where the sun grows cold less similar to the actual world than any world where we had good weather this summer, the sentence in (14) expresses a proposition that is false in the actual world, because none of the closest worlds to the actual world where the sun grows cold are worlds where we have a good crop. The intuition reported in section 1 is then captured.

3. Conclusions

The analysis that I have just presented relies on two assumptions: (i) that *or* introduces propositional alternatives into the semantic derivation (which allows for the semantic composition of counterfactuals to make reference to each disjunct on its own); and (ii) that conditionals are correlatives (which justifies their universal force). To conclude, I would like to consider briefly to what extent these two components are necessary.

The analyses presented in Alonso-Ovalle (2004) and van Rooij (2006) do not rely on either component directly. Instead of assuming that *or* introduces a set of propositional alternatives, each disjunct is made visible via the variable assignment by assuming that disjunctions impose a condition on a variable, as first proposed in Rooth and Partee (1982). The disjunctive antecedent of the sentence in (1) would be analyzed as in (21), where p is a variable of type $\langle s,t\rangle$.

(21) $p \;\&\; (p = \lambda w.\textbf{good-summer}_w \vee p = \lambda w.\textbf{cold}_w(\textbf{s}))$

These analyses do not rely on an external source of universal quantification either. They derive the effect of quantifying over the disjuncts by appealing to the universal force of *would* counterfactuals. *Would* counterfactuals are analyzed as quantifying over pairs $\langle w,g\rangle$ of worlds w and variable assignments g such that g is a variable assignment that maps the variable introduced by *or* to one of its possible values (determined, as in (21), by the disjuncts), and w is a world (i) in which the proposition expressed by the antecedent under g is true, and (ii) that gets as close to the world of evaluation as any other world w' in which the proposition expressed by the antecedent under g is true. *Would* counterfactuals claim that *all* those pairs are pairs that satisfy the consequent.

The main drawback of this type of approach is that it does not directly extend to other conditionals with possibility modals, such as *might* counterfactuals. Take for instance (22):

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

The analysis presented in section 2 directly extends to *might* counterfactuals: it correctly predicts that (22) claims that we might have had a good crop if we had had good weather this summer, and also if the sun had grown cold. But if *might* counterfactuals are duals of *would* counterfactuals, they would say that at least one of the pairs $\langle w,g\rangle$ contributed by the antecedent satisfies the consequent, not that all do.[8] To capture this interpretation, we need to mimic the effects of quantifying over the disjuncts in the antecedent. One possibility, suggested in van Rooij (2006, fn. 26), is this: the semantic interpretation can collect in one set the pairs $\langle w,g\rangle$ such that g maps p to the proposition that we have a good summer and w is one of the closest worlds where we have a good summer, and in another set the pairs $\langle w',g'\rangle$ such that g' maps p to the proposition that the sun grows cold and w' is one of the closest worlds where the sun grows cold. We can then say that the antecedent of the counterfactual contributes a set S containing these two sets, and that both *would* and *might* counterfactuals claim that the consequent follows from *any* member of S. We would end up with an analysis similar to the one proposed in section 2, but in which the source of the universal quantification, rather than being attributed to the fact that conditionals are correlatives, is left unexplained.

[8] For a discussion of this assumption, see Alonso-Ovalle (2006).

To conclude, I would like to comment on the assumption that *if*-clauses are universal quantifiers. Dayal (1996) treats the antecedents of correlatives as definite descriptions: the antecedent of the plural correlative in (13a) denotes the set of properties that are true of the maximal sum of standing girls.

(23) $\lambda P_{\langle e,t\rangle}.P(\iota x[^{*}\mathbf{girl}(x)\ \&\ \mathbf{stand}(x)])$

Should we also assume that *if*-clauses are definite descriptions? If the predicate abstract that *if*-clauses combine with is always distributive (if it is true of a sum of propositions if and only if it is true of all the atomic parts of the sum), we get, in the end, the same truth conditions that we got by assuming a universal quantifier over propositions. But *if*-clauses do not behave like definite descriptions. Consider what happens when we embed a *would* counterfactual under what is presumably a wide scope negation:

(24) It is plain false that Hitler would have been pleased if Spain had joined Germany or the U.S. (Kratzer, p.c., a variation on an example in Nute 1980, p. 157)

If the *if*-clause is a universal quantifier over propositions, the sentence in (24) is predicted to be true if and only if it is false that *both* counterfactuals below are true:

(25) a. Hitler would have been pleased if Spain had joined Germany.
b. Hitler would have been pleased if Spain had joined the U.S.

This is, of course, compatible with one of them being true. The possibility of continuing (24) as in (26) shows that this is the case:

(26) . . . There is enough evidence showing that he might have objected to Spain joining the U.S. If she had joined Germany, he would have been pleased, of course. (Kratzer, p.c.)

If *if*-clauses denoted sums of propositions, and the predicate abstracts associated with the consequents were distributive, the disjunctive counterfactual in (24) could also in principle be true if the predicate abstract is not true of all the propositional alternatives introduced by *or* (but just of one of them). But plural definite descriptions are known to interact with negation in a peculiar way: the sentence in (27) conveys that Sandy saw none of the cats, not just that Sandy didn't see every cat.[9]

(27) Sandy didn't see the cats.

Disjunctive counterfactuals do not seem to behave like plural definite descriptions, then: under negation, they do not convey that the predicate abstract associated with the consequent is true of none of the propositional alternatives introduced by *or*.

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[9] To capture this, a 'homogeneity' presupposition is usually invoked (Loebner, 1998; Schwarzschild, 1994). Beck (2001) formulates homogeneity as follows (where P is a predicate of atomic individuals, $^{*}P$ a pluralized distributive predicate, and A a plurality): $^{*}P(A) = 1$ iff $\forall x[x \in A \rightarrow P(x)]$, $^{*}P(A) = 0$ iff $\forall x[x \in A \rightarrow \neg P(x)]$ (undefined otherwise).

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