Free Choice Counterfactual Donkeys*

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Abstract

We propose a straightforward analysis of counterfactual donkey sentences, by combining the Lewis/Stalnaker analysis of counterfactuals with standard dynamic semantics. The main idea is to define a similarity relation between world-assignment pairs such that two such pairs are unconnected if their assignments differ. We show that with the help of this ordering relation we can also account for a number of related problems involving disjunctions and the use of *any* in counterfactuals and permission sentences.

1 Introduction

During the seventies, semanticists were busy dealing with counterfactuals. In the eighties and early nineties semanticists were heavily occupied taming donkeys, while in recent years every semanticist seems to develop his or her own pet analysis of free choice items. The main aim of this paper is to show that we can straightforwardly analyze counterfactual donkey sentences, by combining the Lewis/Stalnaker analysis of counterfactuals with standard dynamic semantics. This proposal is closely related to – and motivated by – Alonso-Ovalle's (2004) analysis of counterfactuals with disjunctive antecedents, but is, I believe, more straightforward, and fully compositional. I also show in this paper that the main idea behind the proposed analysis

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of counterfactual donkey sentences helps us to account for a number of related problems involving disjunctions and the use of *any* in counterfactuals and permission sentences as well. This paper is organized as follows. In section 2 I discuss the problems of free choice permission, counterfactuals with disjunctive antecedents and the use of *any*, and counterfactual donkey sentences, while in section 3 I propose closely related solutions to these problems. I conclude with section 4.

2 Problems

2.1 Permissions and the free choice effect

Lewis (1970/9) and Kamp (1973, 1979) have proposed a performative analysis of command and permission sentences involving a master and his slave. Following Austin's classical analysis of speech acts, Lewis and Kamp argued that such sentences are not primarily used to make true assertions about the world, but rather to *change* that what the slave is obliged/permitted to do.[1,2] According to this account, if the master commands John to do ϕ by saying 'You must do ϕ', or allows John to do ϕ by saying 'You may do ϕ', it is typically not yet the case that the proposition expressed by ϕ is respectively a superset of, or consistent with, John's permissibility set, P, represented by a set of possible worlds. However, the performative effect of the com-

[1] Although Lewis (1970/9) and Kamp (1973) account for the effect of permission sentences in rather different ways, both might be called performative analyses in the sense that their effect is to change the permissibility set.

[2] In this paper I assume a performative analysis of command and permission sentences. There exists, of course, a whole literature of proposals as to how to account for the free choice inference without adopting a performative analysis. To mention just a few: Zimmermann (2000), Kratzer and Shimoyama (2002), Aloni (2003), Schulz (2004, 2005), Alonso-Ovalle (2005), and Geurts (2005). My favorite analysis along those lines is the proposal made in Schulz (2004, 2005), because it is the only analysis (as far as I know) that is able to fully preserve the standard analysis of disjunction *and* the standard analysis of the modals. In terms of this analysis, the free choice effect of the following examples (mentioned by one reviewer) can all easily be accounted for:
(i) John said/thinks that Bill may take an apple or a pear.
(ii) According to the rules, you may take an apple or a pear.
(iii) John can/is able to bake you a cake or a pie.
(iv) At that point, Jones could have become a doctor or a lawyer.
I will ignore such examples in this paper, although they suggest (as argued by Schulz) that having a performative explanation is not enough to account for all free choice effects.

mand/permission will be such that in the new context what is commanded is a superset of, and what is permitted is consistent with, the new permissibility set. Thus, in case the command or permission is not used vacuously, the permissibility set, P', of the new context will be different from P, so that the obligation/permission sentence will be satisfied. Our problem is to say how command and permission sentences govern the change from the prior permissibility set, P, to the posterior one, P'.

For commands this problem seems to have an easy solution. If the command 'You must do ϕ' is given by the master, the new, or posterior, set of permissible futures for John, P', is simply $P \cap [\phi]$, where $[\phi]$ denotes the proposition expressed by ϕ.[3,4] However, things are more complicated for permission sentences. It is clear that if ϕ is allowed, P' should be a superset of P such that $P' \cap [\phi] \neq \emptyset$. It is not clear, however, which ϕ-worlds should be added to P. Obviously, we cannot simply say that $P' = P \cup [\phi]$. By that suggestion, giving permission to ϕ would allow everything compatible with ϕ, which is certainly not what we want. But how then should the change from P to P' be determined if a permission is given? This is Lewis's problem about permissions.

One possible way to solve Lewis's problem about permissions is to assume that we not only have a set of best, or ideal, worlds, but also an ordering that says which non-ideal worlds are better than others (cf. Kamp, 1979). Thus, to account for the performative effects of commands and permissions, we need not only a set of ideal worlds, but rather a whole preference, or reprehensibility, ordering, $\leq$, on the set of all possible worlds. On the interpretation that $u \leq v$ iff v is at least as reprehensible as u, it is natural to assume that this relation should be reflexive, transitive, and connected.[5] In terms of this preference order on possible worlds we can determine the ideal set P as the set of minimal elements of the relation $\leq$:

$$P \quad \stackrel{def}{=} \quad \{v \in W | \ \forall u : \ v \leq u\}$$

In terms of this set of ideal worlds we can determine whether according to the present state ϕ is obligatory or just permitted. For instance, ϕ is obligatory

[3]Here, and in the rest of the paper, I ignore the fact that the interpretation function '$[\cdot]$' should be related to a (modal) model.

[4]What if the new command is incompatible with one or more of the earlier ones? In that case we might make use of change by revision to be discussed below.

[5]Reflexive: for all w : $w \leq w$; transitive: for all w, v and u: if $w \leq v$ and $v \leq u$, then $w \leq u$; connected: for all w and v, $w \leq v$ or $v \leq w$.

iff $P \subseteq [\phi]$.

But this ordering relation contains more information than just what the set P of ideal worlds is, and in terms of this extra information we can determine the new permissibility set P'. If the master permits the slave to make ϕ true, we can assume that P contains no ϕ-worlds, i.e. none of the ϕ-worlds is ideal. But some ϕ-worlds are still better than other ϕ-worlds. We can now propose that the effect of allowing ϕ is that the best ϕ-worlds are added to the old permissibility set to figure as the new permissibility set. The best ϕ-worlds are the worlds 'closest' to the 'ideal' worlds P where ϕ is true. This set will be denoted as P^*_ϕ and defined in terms of the relation $\leq$ as follows:

$$P^*_\phi \quad \stackrel{\text{def}}{=} \quad \{u \in [\phi] |\ \forall v \in [\phi] : u \leq v\}$$

To implement this suggestion, we can say that the change induced by the permission 'You may do ϕ' is that the new permission set, P', is just $P \cup P^*_\phi$. Thus, according to Kamp's (1979) proposal, command and permission sentences change a context of interpretation as follows (where I assume that John is the relevant agent, and P his permission state):

$$Upd(Must(John, \phi), P) \stackrel{def}{=} P \cap [\phi]^6$$
$$Upd(May(John, \phi), P) \stackrel{def}{=} P \cup P^*_\phi$$

Note that according to our performative account it does not follow that for a permission sentence of the form 'You may do ϕ or ψ' the slave can infer that according to the new permissibility set he is allowed to do any of the disjuncts. Still, Kamp's analysis can give an explanation why disjuncts are normally interpreted in this 'free-choice' way. To explain this, let me first define a deontic preference relation between propositions in terms of our reprehensibility relation between worlds, $\leq$. We can say that although both ϕ and ψ are incompatible with the set of ideal worlds, ϕ is still preferred to $\psi, \phi \preceq \psi$, iff the best ϕ-worlds are at least as close to the ideal worlds as the best ψ-worlds, $\exists v \in [\phi]$ and $\forall u \in [\psi] :\ v \leq u$. Then we can say that with respect to $\leq$, ϕ and ψ are equally reprehensible, $\phi \approx \psi$, iff $\phi \preceq \psi$ and $\psi \preceq \phi$. Because, as it turns out, it will be the case that $P^*_{\phi\vee\psi} = P^*_\phi \cup P^*_\psi$ iff $\phi \approx \psi$, Kamp can explain why normally disjunction elimination is allowed for permission sentences. For simple disjunctive permission sentences like 'You

[6] This is, in fact, just P^*_ϕ, if it is assumed that ϕ is compatible with P.

may do ϕ or ψ', it is not unreasonable to assume that when performatively used, the master has no strict preference for the one above the other. If we make the same assumption for command sentences, it follows that from 'You may/must take the apple or the pear' we can conclude that the hearer may take the apple and that he may take the pear.

Kamp (1973) argues that just as we can define an inference relation between propositions, we might also define an inference relation between performatively used permission sentences, which he called 'p-entailment'. In terms of our framework, he proposes that permission sentence $May(j, \psi)$ is p-entailed by permission sentence $May(j, \phi)$, iff for every appropriate initial permissibility ordering $\leq$, no new worlds would be added to the set of ideal worlds through the use of $May(j, \psi)$ after the initial permissibility set was 'updated' through the use of $May(j, \phi)$. On the assumption that $\leq$ can only be an appropriate initial permissibility ordering for the performatively used $May(j, \phi \vee \psi)$ iff $\phi \approx \psi$, we can derive the free choice inference in terms of the notion of p-entailment.[7] Notice that Kamp's notion of p-entailment is rather close to Veltman's (1996) fixed-point notion of entailment between speech acts.

Unfortunately, Kamp's performative analysis of permission sentences gives rise to some problems, though some of these are more easily solved than others. A first worry, discussed at length in Merin (1992), is that it seems to make the wrong predictions for *conjunctive* permissions. Indeed, it is the case that if we update context P to interpret 'You may take the apple and the pear' by $P \cup P^*_{\phi \wedge \psi}$, we either end up with a permission set where the hearer may take neither the apple nor the pear, or with a permission set where the hearer may take both of them: the package deal effect.[8] This is wrong, because, intuitively, the speaker also allows the hearer to take the apple, without taking the pear. Fortunately, this problem can be solved easily once we allow the conjunction to take wide scope over the permission (van Rooy, 2000). A more serious problem is that the performative analysis seems to be limited to the free choice inference for permissions and commands, but cannot account for the similar inference when *epistemic* necessity or possibility is involved, i.e., the fact that we typically infer from 'Ede must/might be in Berlin or in Frankfurt' that the speaker thinks it is both possible that

[7]Notice that according to this entailment relation we do not predict that we can infer $May(j, \phi \vee \psi)$ from $May(j, \phi)$, and thus that Ross' paradox does not arise.

[8]At least, we end up with this package deal effect if P is inconsistent with ϕ and with ψ.

Ede is in Berlin, and that he is in Frankfurt (cf. Zimmermann, 2000). A final problem is that the explanation of the free choice problem makes use of a strong assumption: the assumption that the disjuncts are equally reprehensible. The worry here is that one might say 'You may take the apple or *even* the pear', where the focus particle '*even*' suggests that in the conversational context (before the utterance was made), taking the apple was taken to be less reprehensible than taking the pear.[9] Intuitively, however, from this permission the hearer would still infer that he is allowed to take the pear. Similarly, it is unclear how this analysis can account for the intuition that 'You may take *any* apple' is felicitous, and that the hearer can conclude from it that the speaker doesn't care which apple he takes, whatever was the reprehensibility ordering before the permission was given. The inference problem should be obvious now, but it is also unclear what licenses the use of *any* here.

I want to propose that the example involving epistemic *might* can be solved easily once we also adopt a performative analysis of such statements. Traditionally (e.g. Veltman, 1996), a statement of the form 'It might be that ϕ' is analyzed as being true, or asserted appropriately, when ϕ is compatible with the common ground. Although there is not so much wrong with this analysis, it clearly can't be the whole story, because it would make such statements rather pointless. Intuitively, what such a statement does is that it brings the possibility that ϕ is true to the attention of the hearer. This doesn't mean that before the utterance was made the hearer ruled out that ϕ is possible, but just that among the worlds compatible with what is presupposed, or believed, by the hearer, the possibilities where ϕ is the case were not very salient. The performative effect of the possibility statement is then exactly to increase the salience of such possibilities. We might account for this formally in just the same way as we accounted for the performative effects of permission sentences. The only difference is that the set P now is not the set of admissible worlds, but rather those worlds among the ones that are compatible with what is presupposed that are most salient. The performative effect of 'It might be that ϕ' is now just to update the set of most salient worlds from P to $P \cup P^*_\phi$. Obviously, if we assume that ϕ was equally (un)salient as ψ, the free choice inference that it might be that ϕ and it might be that ψ follows from statements of the form 'It must/might be that ϕ or ψ'.

[9]Thanks to Manfred Krifka (p.c.) for this kind of example.

I find this performative analysis of epistemic statements appealing. Unfortunately, however, it only increases the last mentioned problems discussed above. How can we now account for the fact that 'Ede might be in Berlin, or *even* in Frankfurt' and 'Ede might be *anywhere*' give rise to the free choice inferences that seem impossible to cancel? This is just as problematic as the fact that the free choice inferences seem to be impossible to cancel from sentences of the form 'You may take the apple, or *even* the pear', and 'You may take *any* apple'. Moreover, it is unclear how we can account for the licensing of *any* in epistemic possibility statements on the standard reading of the modal. In the following, I will concentrate on permission sentences, assuming that the epistemic variant can be accounted for in a similar way. Before we come to our proposal, however, let me discuss in the next few sections some other problems that are very closely related, and for which I would like to propose a similar solution.

2.2 Counterfactuals with disjunctive antecedents

Stalnaker (1968) and Lewis (1973) gave the following well-known analysis of (counterfactual) conditional sentences represented by $\phi > \psi$:

> $\phi > \psi$ is true at w if some $\phi \wedge \psi$-worlds are closer to w than any $\phi \wedge \neg\psi$-worlds.

The notion 'closer ϕ-world to w than' can be explained in terms of an ordering relation on the accessible worlds (but let us assume that all worlds are accessible). The ordering relation '$\leq_w$' between worlds is required to obey the following conditions: reflexivity, transitivity, connectedness, and strong centering.[10] The intuitive meaning of $u \leq_w v$ is that u is at least as close, or similar, to w as v is. Accepting the limit assumption, i.e., $[\phi] \neq \emptyset \Rightarrow \{v \in [\phi] : \forall u \in [\phi] : v \leq_w u\} \neq \emptyset$ (or limiting our analysis to the finite case), we can reformulate the semantics of counterfactuals in terms of a selection function. Let us define a selection function f in terms of the similarity relation as follows: $f_w([\phi]) = \{v \in [\phi] | \forall u \in [\phi] : v \leq_w u\}$. The proposition expressed by the conditional $\phi > \psi$ is now the following set of possible worlds:

$$[\phi > \psi] \quad \stackrel{def}{=} \quad \{w \in W : f_w([\phi]) \subseteq [\psi]\}$$

[10]strong centering; $\forall v : w \neq v \Rightarrow (w \leq_w v \text{ and } v \not\leq_w w)$.

That is, $\phi > \psi$ is true in w iff ψ is true at every closest ϕ-world to w, or ϕ is impossible.[11]

It seems reasonable that any adequate theory of counterfactuals must account for the fact that at least most of the time instantiations of the following formula (Simplification of Disjunctive Antecedents, SDA) are true:

$$\text{(SDA)} \quad ((\phi \vee \chi) > \psi) \rightarrow ((\phi > \psi) \wedge (\chi > \psi))$$

For instance, intuitively we infer from (1-a) that both (1-b) and (1-c) are true:

(1) a. If Spain had fought on either the Allied side or the Nazi side, it would have made Spain bankrupt.
b. If Spain had fought on the Allied side, it would have made Spain bankrupt.
c. If Spain had fought on the Nazi side, it would have made Spain bankrupt.

The Lewis/Stalnaker analysis cannot account for these inferences because SDA is not a theorem of its logic. In fact, if we would change the logic by making SDA valid, i.e., by saying that $f_w([\phi \vee \chi]) = f_w([\phi]) \cup f_w([\chi])$, the theory looses one of its most central features, its non-monotonicity. As noted by Warmbrod (1981), by accepting SDA, we can derive MON on the assumption that the connectives are interpreted in a Boolean way.

$$\text{(MON)} \quad (\phi > \psi) \rightarrow (((\phi \wedge \chi) > \psi))$$

The reason is that from $\phi > \psi$ and the assumption that connectives are interpreted in a Boolean way, we can derive $((\phi \wedge \chi) \vee (\phi \wedge \neg\chi)) > \psi$. By SDA we can then derive $(\phi \wedge \chi) > \psi$.

Warmbrod (1981), followed by a number of other authors (e.g. Frank, 1997), have responded to this problem by abandoning the non-monotonic analysis of counterfactuals in favor of a (context dependent) strict conditional one, according to which both SDA and MON are valid. In fact, such

[11] Of course, Stalnaker's analysis is still stronger, because he makes the additional assumption that for all $[\phi] \subseteq W$ and $w \in W : f_w([\phi])$ is always a singleton set. In terms of the similarity relation between worlds, this means that Stalnaker assumes that $<_w$ obeys trichotomy: $\forall u, v : \; u <_w v$ or $v <_w u$ or $u = v$.

a strict conditional account has an additional – and closely related – advantage as well. As is well-known, the negative polarity item *any* is licensed in antecedents of counterfactuals (cf. Heim, 1984).

(2) If *any* man would have seen it, we would have known about it.

On Ladusaw's (1979) hypothesis this would mean that we would like to have an analysis of counterfactuals that predicts that their antecedents are downward entailing. Obviously, antecedents don't behave that way according to Lewis and Stalnaker: this is exactly what their non-monotonic analysis of counterfactuals amounts to. In contrast to their analysis, however, a strict conditional analysis of counterfactuals immediately accounts for the appropriateness of (2), because antecedents of strict conditionals are predicted to be DE contexts.[12]

I this paper I don't want to question that (something like) a strict conditional account can explain our intuitions involving the use of disjuncts and (certain) negative polarity items in antecedents of counterfactuals. However, an analysis as strict conditional must make the meaning of counterfactuals extremely context dependent where accommodation is the rule, rather than the exception. In this paper I don't want to argue against a strict conditional analysis of counterfactuals, but just want to show that sentences like (1-a) and (2) don't force us to give up our well-known non-monotonic analysis of counterfactuals along the lines of Lewis and Stalnaker.

2.3 Counterfactual donkey sentences

Until now we have assumed that the meaning of a sentence can be represented adequately by a set of possible worlds. It is well-known, however, that this leads to problems for the analysis of indefinites and pronouns, especially in donkey sentences. Of course, Kamp (1981) and Heim (1982) showed that we could maintain a uniform analysis of indefinites and pronouns, and still get the truth conditions of donkey sentences right, while Groenendijk and Stokhof (1991) and others have demonstrated that such an analysis is actually no threat to compositionality, if we are willing to change our static possible-world conception of the meaning of a sentence. According to the alternative dynamic view, we interpret sentences with respect to a context

[12]Among others for this reason, a (context-dependent) strict conditional account has been argued for by Kadmon and Landman (1993) and von Fintel (1999, 2001).

that is represented by a set of world-assignment pairs, and the meaning of the sentence itself can be thought of as the update of this context, where possibilities are *eliminated* when the sentence is false, and the assignment of the possibilities is *enriched* if a new variable, or discourse referent, is introduced by way of an indefinite.[13] According to this analysis, the formula $\exists x[Px] \rightarrow Qx$ is predicted to be equivalent with $\forall x[Px \rightarrow Qx]$, which means that we can account for (standard) donkey sentences in a systematic and compositional way.

Although a considerable amount of attention has been devoted to donkey sentences in the past, only a particular branch of donkey sentences were actually inspected: indicative ones. To account for these indicative donkey sentences it was no problem to assume that conditional sentences should be analyzed (basically) in terms of material implication. But donkey sentences not only show up in indicative mood; we have counterfactual donkey sentences as well:

(3) If John owned a donkey, he would beat it.

Representing counterfactuals as $\phi > \psi$ like before, we would like to represent (3) abstractly as $\exists x[Px] > Qx$, while still being equivalent with $\forall x[Px > Qx]$. The challenge is to account for this equivalence, without giving up our standard dynamic account of indefinites.

Suppose that we want to interpret a sentence of the form $\exists x\phi > \psi$ in possibility $\langle w, g\rangle$. According to the standard Lewis/Stalnaker analysis of counterfactuals, we should then select among those possibilities that verify $\exists x\phi$ the ones that are closest to $\langle w, g\rangle$ and check whether they also make ψ true. Because ϕ might contain free variables that should be interpreted by means of g, the natural context of interpretation of $\exists x\phi$ is the set $W(g) = \{\langle v, h\rangle : v \in W \ \& \ h = g\}$.[14] After the interpretation of $\exists xPx$, for instance, we end up with a set of world-assignment pairs like $\langle v, h\rangle$ where variable x is in the domain of assignment h, and $h(x)$ is an element of the set denoted by P in world v. Let us denote this set of world-assignment pairs by $/\exists xPx/_g$. To check whether $\exists x[Px] > Qx$ is true in $\langle w, g\rangle$ we have to select among the possibilities in $/\exists xPx/_g$ those that are closest to

[13] I assume here that assignments are partial functions.

[14] Just like Lewis (1973), we might want to limit the worlds considered by means of an accessibility relation. I will ignore this possibility in this paper. Also, I will assume for simplicity that all worlds have the same domain.

$\langle w, g\rangle$, and see whether they also verify Qx. But this means that we need an ordering relation, $\leq^*_{\langle w,g\rangle}$, between world-assignment pairs with respect to possibility $\langle w, g\rangle$: $\langle u, k\rangle \leq^*_{\langle w,g\rangle} \langle v, h\rangle$. Let us assume that we can analyze counterfactuals in terms of selection functions, as before, and that $\phi > \psi$ is true in possibility i just in case ψ is true in all selected ϕ-possibilities closest to i, i.e. in all $j \in f^*_i(/\phi/_g)$. It is clear what we want the result to be: we want $f^*_{\langle w,g\rangle}(/\exists xPx/_g)$ to be $\bigcup_{d\in D} f^*_{\langle w,g\rangle}(\{\langle v, g[^x/_d]\rangle : d \in I_v(P)\})$. On such an analysis, we would be able to account for (3) without necessarily giving up on a non-monotonic analysis of counterfactuals.[15] On the other hand, it is clear that we don't want to *define* $f^*_{\langle w,g\rangle}(/\exists xPx/_g)$ to be the desired set.[16] For in that case, our analysis wouldn't be compositional anymore. What we want, instead, is to first determine the (dynamic) interpretation of $\exists xPx$, i.e. $/\exists xPx/_g$, and then define the selection function f^*, or the ordering relation $\leq^*_{\langle w,g\rangle}$, such that the set of selected world-assignment pairs is identical with $\bigcup_{d\in D} f^*_{\langle w,g\rangle}(\{\langle v, g[^x/_d]\rangle : d \in I_v(P)\})$.

3 Solution

3.1 Counterfactual donkey sentences

Fortunately, there is a natural way to define an ordering '$\leq^*$' between world-assignment pairs in terms of the ordering relation between worlds used by Lewis and Stalnaker:[17]

Definition 1 Given a Lewis/Stalnaker similarity relation $\leq_w$ between worlds, we define the similarity relation $\leq^*_{\langle w,g\rangle}$ between world-assignment pairs as follows: $\langle v, h\rangle \leq^*_{\langle w,g\rangle} \langle u, k\rangle$ iff$_{def}$ $h = k \supseteq g$ and $v \leq_w u$.

Notice, first, that in case the antecedent ϕ of a counterfactual doesn't introduce new variables, or discourse markers, all the elements of $/\phi/_g$ are world-assignment pairs with assignment g. Thus, in that case '$\leq^*$' comes

[15] We don't have to assume that in order for the counterfactual $\phi > \psi$ to be true in possibility $\langle w, g\rangle$, the counterfactual $(\phi \wedge \chi) > \psi$ also has to be true.

[16] In terms of our framework, this is essentially what the proposal of Alsonso-Ovalle (2004) comes down to. Still, Alonso-Ovalle's paper was the main impetus for the solution I propose in the next section.

[17] The same ordering has been used in Schulz and van Rooij (to appear) to account for some apparent problems of exhaustive interpretation.

down to '$\leq$', because we can now ignore the assignment function. But suppose that ϕ is of the form $\exists x Px$. In that case, all the assignments in $/\exists x Px/_g$ differ from g in that they also assign an object to x. Let $\langle v, h\rangle$ and $\langle u, k\rangle$ be two possibilities in $/\exists x Px/_g$. According to definition 1, to check whether the one is more similar to $\langle w, g\rangle$ than the other only makes sense in case h assigns the same individual to x as k, $h(x) = k(x)$.[18] But this means that we check for each individual d separately what are the closest possibilities to $\langle w, g\rangle$ that make Px true. We define the selection function as follows:

Definition 2 Given a similarity relation $\leq^*_{\langle w,g\rangle}$ between world-assignment pairs as defined in definition 1, we define the selection function f^* from sets of world-assignment pairs to sets of world-assignment pairs as follows:

$$f^*_{\langle w,g\rangle}(/A/_g) \stackrel{def}{=} \{\langle v, h\rangle \in /A/_g : \neg\exists\langle u, k\rangle \in /A/_g : \langle u, k\rangle <^*_{\langle w,g\rangle} \langle v, h\rangle\},$$
$$\text{where } /A/_g = [A](\{\langle v, h\rangle : v \in W \ \&\ h = g\}), \text{ and}$$
$$j <^*_i k \text{ iff } j \leq^*_i k \text{ but not } k \leq^*_i j.$$

It is easy to see that it now follows that $f^*_{\langle w,g\rangle}(/\exists x Px/_g)$ comes out to be equivalent with $\bigcup_{d\in D} f^*_{\langle w,g\rangle}(\{\langle v, g[^x/_d]\rangle : d \in I_v(P)\})$. As we have seen above, this is exactly what we want, but now we don't *define* the selection function this way (which would give rise to a non-compositional analysis), but we still end up with the same happy result that $\exists x[Px] > Qx$ is equivalent with $\forall x[Px > Qx]$.[19,20,21] I conclude that we can account for counterfactual donkey-sentences in a natural and compositional way.

[18] Though the relation '$\leq$' is connected, '$\leq^*$' is not.

[19] To be sure, this equivalence holds for many-ary donkey sentences as well: if $\vec{x}$ is an n-ary tuple of variables and ϕ and ψ are n-ary predicates, our analysis predicts that $\exists\vec{x}[\phi(\vec{x})] > \psi(\vec{x})$ is equivalent with $\forall\vec{x}[\phi(\vec{x}) > \psi(\vec{x})]$.

[20] Notice that this would also be true if we would make Stalnaker's uniqueness assumption.

[21] In contrast to Lewis, Stalnaker assumed that indicative conditionals should be treated in the same way as counterfactuals. Adopting that view, one might expect that the standard dynamic analysis of standard donkey sentences would come out as a special case of our analysis. This is not exactly the case. On our analysis, for $\exists x[Px] > Qx$ to be true in world w where P has a non-empty extension it is not enough that all individuals in the extension of P also have property Q. However, if we limit the domain of quantification in the indicative case to the individuals that have property P, the standard dynamic analysis is only a special case.

3.1.1 Identifying and weak counterfactual donkey sentences

Although I believe that a counterfactual donkey sentence is in general equivalent to a formula with wide scope universal quantification, there is a particular type of example for which this equivalence seems rather dubious: what I would call *identifying* counterfactual donkey sentences:[22]

(4) a. If Alex were married to a girl from his class, it would be Sue.
b. If a boy from our class had married a girl from our class, he would have married Sue (and only Sue).
c. If Ed was talking to a woman at the Ling. Department's front desk, he would have realized that it was Kathryn.

Isn't it obviously too strong a claim to say that (4-a), for instance, is true just in case for any individual (e.g. Mary), if that individual were from Alex's class and married to him, it would be Sue? Yes, this would be too strong if we assume that the individuals in the domain have essential properties, like 'being Mary'. If we give up that assumption, however, the reading is, I claim, much more natural.[23] Alternatively – although it would implement a similar intuition –, we could say that not all indefinites introduce discourse referents and that the indefinites used in the antecedents of (4-a)-(4-c) are of this type. The anaphora used in the consequents of (4-a) and (4-c) are then descriptive pronouns. But I don't want to sell my analysis only to anti-essentialists, or to those who don't mind indefinites and anaphora to be ambiguous, and will allow for weaker readings of counterfactual donkey sentences such that (4-a)-(4-c) receive acceptable truth conditions also from a more essentialist's and standard dynamic semantics' point of view.

The donkey equivalence in standard DRT and dynamic semantics depends on the assumption of unselective binding. I made that assumption in the previous section, and will make it in the rest of this paper as well. However, this gives rise to the problem of how we can account for weak readings of donkey sentences ('If I have a dime in my pocket, I throw it into the parking meter') and for asymmetric readings of adverbs of quantification (the proportion problem). The standard way to solve those problem in dynamic semantics (going back to Root (1986) and also defended in Dekker

[22]The following examples were provided by a reviewer of this paper, but Frank Veltman gave similar examples.

[23]Martin Stokhof suggested that we call this the 'epistemic' reading of the counterfactual.

(1993)) is to give up unselective binding for all variables involved. The idea is to unselectively bind only a *subset* of all the variables introduced in the antecedent of the conditional, and for those where you don't do this, the weak reading follows. The nice thing about this solution is that (i) one still treats all indefinites in the same way, and (ii) the indefinite whose introduced variable is not unselectively bound can still be picked up anaphorically in the consequent (this is relevant for examples (4-a) and (4-c) above.)

So, how does this work for counterfactual donkey sentences? Well, we will represent a counterfactual in general by a formula $\phi >^X \psi$, where ϕ and ψ are as expected, and X is the set of variables introduced by ϕ that is unselectively bound. Notice that even if ϕ contains an indefinite, X might still be the empty set. Now we are going to slightly redefine the ordering relation between possibilities as follows:

Definition 3 Given a Lewis/Stalnaker similarity relation $\leq_w$ between worlds, we define the similarity relation $\leq^{*,X}_{\langle w,g\rangle}$ between world-assignment pairs as follows: $\langle v,h\rangle \leq^{*,X}_{\langle w,g\rangle} \langle u,k\rangle$ iff$_{def}$ $h,k \supseteq g$, $h\uparrow^X = k\uparrow^X$, and $v \leq_w u$.

where $h\uparrow^X$ denotes the restriction of h to X, and thus that $h\uparrow^X = k\uparrow^X$ iff $\forall x \in X : h(x) = k(x)$. What this definition comes down to is a weakening of definition 1, because it now allows for a comparison between possibilities where the assignments are not the same. In particular, if $X = \emptyset$ it immediately holds that the assignments are irrelevant for the ordering relation: $\langle v,h\rangle \leq^{*,\emptyset}_{\langle w,g\rangle} \langle u,k\rangle$ iff $v \leq_w u$.

If one makes the assumption that one can only be married to one girl, or that Ed was talking to at most one woman, this small, but independently motivated, change already accounts for all of the examples (4-a)-(4-c) discussed above, without making the assumption that indefinites are ambiguous. If we redefine the selection function as follows: $f^{*,X}_{\langle w,g\rangle}(/\phi/_g) = \{\langle v,h\rangle \in /\phi/_g : \neg\exists\langle u,k\rangle \in /\phi/_g : \langle u,k\rangle <^{*,X}_{\langle w,g\rangle} \langle v,h\rangle\}$, example (4-a), for instance, is predicted to be true if represented such that $X = \emptyset$ just in case Alex is married to Sue (and only Sue) in the world(s) closest to the actual one where Alex is married to a(ny) girl from his class.

But what should we do about counterfactual variants of *weak* donkey sentences?

(5) If I had a dime in my pocket, I would throw it into the meter.

To account for weak readings of counterfactual donkey sentences, we have to assume that there are possibilities closest to the actual world where I have more than one dime in my pocket. What is required to account for such cases is to lump together all of the possibilities where the difference in assignment doesn't matter, and say that only one of those assignments has to be taken into account for the interpretation of the consequent. Let us first say that $\langle v, h \rangle \sim^X \langle u, k \rangle$ iff $v = u$ and $h \upharpoonright^X = k \upharpoonright^X$. Then we say that $\phi >^X \psi$ is true in $\langle w, g \rangle$ iff $\forall \langle v, h \rangle \in f^{*,X}_{\langle w,g \rangle}(/\phi/_g) : \exists \langle u, k \rangle \in f^{*,X}_{\langle w,g \rangle}(/\phi/_g) : \langle u, k \rangle \sim^X \langle v, h \rangle$ and $\langle u, k \rangle$ verifies ψ. Now we can account for the truth of the weak counterfactual donkey (5) where in the closest counterfactual world(s) I have more than one dime in my pocket. In the rest of this paper I won't come back to identifying or weak readings of counterfactual donkey sentences and will always assume unselective binding.

3.2 Counterfactuals with disjunctive antecedents

Now we know how to account for counterfactual donkey sentences, it becomes straightforward how to account for counterfactuals with disjunctive antecedents. The reason is, of course, that disjunctive sentences can simply be represented by existential sentences (cf. Alonso-Ovalle, 2004). Let 'P' denote the property that Spain fought on the x-side. In that case we can represent (1-a) by $\exists x[Px \wedge (x = allied \vee x = nazi)] > Spain\ bankrupt$.[24]

(1-a) If Spain had fought on either the Allied side or the Nazi side, it would have made Spain bankrupt.

Given our analysis of counterfactual donkey sentences above, it is quite clear that we now predict that from (1-a) we can indeed infer that (1-b) and (1-c) follow.

[24]In the main text I illustrate the proposal to account for the problem of simplication of disjunctive antecedents in terms of donkey anaphora in counterfactuals by means of disjunctions of type e. But this is for illustrative purposes only: the analysis works for disjunctions of any type. And this is needed as well: as mentioned by one reviewer, from an example like 'If John had bought a car or borrowed a motorcycle, he'd be on time' we intuitively infer 'If John had bought a car, he'd be on time and if John had borrowed a motorcycle, he'd be on time'. In fact, Alonso-Ovalle (2004) proposed his analysis for disjunctions of type $\langle e, t \rangle$.

(1-b) If Spain had fought on the Allied side, it would have made Spain bankrupt.
(1-c) If Spain had fought on the Nazi side, it would have made Spain bankrupt.

Our analysis explains why counterfactuals with disjunctive antecedents allow for simplification of the antecedent.[25,26]

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[25]McKay and van Inwagen (1977), however, present the following example, which shows that we don't want SDA to be valid in general: from (i) we don't want to conclude (ii):

(i) If Spain had fought on either the Allied side or the Nazi side, it would have fought on the Nazi side.
(ii) If Spain had fought on the Allied side, it would have fought on the Nazi side.

I conclude that counterfactuals with disjunctive antecedents do not falsify the Lewis/Stalnaker account: we cannot conclude *If* ϕ*, then* ψ from all instantiations of (subjunctive) conditionals of the form *If* ϕ *or* χ*, then* ψ. On the analysis suggested in section 3.1 this means that either not all counterfactuals with disjunctive antecedents should be represented by means of existential quantifiers (see Alonso-Ovalle (2004) for this type of move), or that the variable introduced by the quantifier representing the disjunction is irrelevant for the ordering relation (as proposed in section 3.1.1). On neither analysis, SDA is guaranteed to be valid. One reviewer noticed that for counterfactuals of the form '$\neg(\phi \wedge \chi) > \psi$' we typically make an SDA-type of inference: $\neg\phi > \psi$ and $\neg\chi > \psi$, although that is not (immediately) predicted by the proposed analysis:

(iii) If Jack had not seen both Mary and John, he would be unhappy.

To account for such examples – as also suggested by the reviewer – I could, and would, either represent them as I would represent (iv), i.e. as (v):

(iv) If Jack had not seen Mary or had not seen John, he would be unhappy.
(v) $\exists x[\neg Px \wedge (x = m \vee x = j)] > \psi$.

or would represent them more in line with their surface form, in which case the simplification inference is not guaranteed to go through, but depends on the ordering relation.

[26]Alonso-Ovalle (p.c.) has the intuition that 'Might'-counterfactuals of the form $(\phi \vee \chi) > \Diamond\psi$ should intuitively entail both $\phi > \Diamond\psi$ and $\chi > \Diamond\psi$. Neither his own analysis from 2004, nor my analysis can account for this. Fortunately, there is an easy way out of this problem. In the main text we have assumed that $f^*_{\langle w,g\rangle}(/\phi/_g)$ is a set of world-assignment pairs. But we might redefine the selection function such that it rather denotes a set of sets of world-assignment pairs: $f^+_{\langle w,g\rangle}(/\phi/_g) = \{\{\langle v,h\rangle \in /\phi/_g : \neg\exists\langle u,k\rangle \in /\phi/_g : \langle u,k\rangle <_{\langle w,g\rangle} \langle v,h\rangle\} : h \in G\}$. If we now assume that $\phi > \psi$ is true in $\langle w,g\rangle$ iff ψ is entailed by each set in $f^+_{\langle w,g\rangle}(/\phi/_g)$, this still gives rise to a compositional analysis, but one where 'Might'-counterfactuals have Alsono-Ovalle's desired truth conditions (at least,

Let us now turn to example (2) and see whether our new analysis can account for the appropriateness of negative polarity item *any* in the antecedent of a counterfactual. Obviously, we cannot account for the licensing of *any* on the standard DE-analysis: although we slightly changed the analysis of counterfactuals, it is still not predicted on our analysis that the antecedent of a counterfactual forms a downward entailing context. Fortunately, the DE-analysis is not the only analysis of NPI-licensing around. For both empirical and conceptual reasons, Kadmon and Landman (1993) and Krifka (1995) have argued in favor of a more pragmatic analysis of licensing NPIs. Kadmon and Landman (1993), for instance, have argued that the semantic meaning of *any* is just the same as that of an indefinite like *some* – i.e., that of the existential quantifier –, but with a *wider* domain of quantification. To account for licensing, they claim that the NPI *any* can be used appropriately just in case the interpretation of the sentence after domain widening is *stronger* than before widening. Because domain widening of existential quantifiers in downward entailing contexts results in stronger assertions, the DE-analysis is explained rather than simply assumed. But the widening analysis of NPIs is not only more explanatory, it is also more general, because it can account for the appropriateness of sentences involving *any* although the NPI (or FC item) does not occur in a DE context (cf. Kadmon and Landman, 1993, and, e.g., van Rooij, 2003). Indeed, domain widening also explains why *any* is licensed in antecedents of counterfactuals. Let us represent a sentence like (2) by a formula like $\exists x_D[Px] > q$ where D is the domain of quantification. Notice that on our analysis it straightforwardly follows that if $D' \subset D$, $\exists x_{D'}[Px] > q$ is strictly weaker than $\exists x_D[Px] > q$. For instance, if $D' = \{d_1\}$ and $D = \{d_1, d_2\}$, then $\exists x_D[Px] > q$ has the same truth conditions as the conjunction $(P(d_1^*) > q) \wedge (P(d_2^*) > q)$, while $\exists x_{D'}[Px] > q$ just means $P(d_1^*) > q$, and is thus weaker (I assume here that d^* is the name of d). But this means that according to the widening analysis, in combination with our analysis of counterfactual donkey sentences, *any* is predicted to be licensed in antecedents of counterfactuals, just as desired.

3.3 Permission sentences

As it turns out, a very similar change of the ordering relation relevant for the (performative) analysis of permission sentences as what we used above for

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if disjunctions are analyzed in terms of dynamic quantification).

counterfactuals solves our remaining problems in section 2.1 as well. Let us represent 'You may take *any* apple' by a formula of the form '$May(j, \exists x Px)$'. As above, I will assume that existential quantifiers should be analyzed dynamically. This means that $/\exists x Px/_g$ is not the set of possible worlds where there is an object that has property P, but rather the set of world-assignment pairs, $\langle v, h\rangle$, where the object $h(x)$ has property P in v. Given that the truth-set of an existential formula involves not only worlds but also assignments, we are forced to adjust our performative analysis of permission sentences as sketched in section 2.1, because that analysis was based on an ordering relation '$\leq$' that involves worlds only. Fortunately, just as for the analysis of counterfactuals, also now there is a natural way to define an ordering '$\leq^*$' between world-assignment pairs in terms of our previous ordering relation between worlds: we define $\langle v, h\rangle \leq^* \langle u, k\rangle$ iff$_{def}$ $h = k$ and $v \leq u$. We will still assume (for simplicity) that the permission set P is represented by a set of worlds, and define the set of ϕ worlds 'closests' to the 'ideal' worlds P where $/\phi/_g$ holds as follows:

$$P^*_{/\phi/_g} \stackrel{def}{=} \quad \{v \in W |\ \exists h : \langle v, h\rangle \in /\phi/_g \ \&\ \neg\exists \langle u, k\rangle \in /\phi/_g : \langle u, k\rangle <^* \langle v, h\rangle\}.$$

This minor adjustment has the important consequence that if the domain of quantification involves only three apples, a_1, a_2, and a_3, the permission 'You may take *any* apple', represented abstractly by '$May(j, \exists x Px)$', is predicted to give rise to the inference that the hearer may take apple a_1, apple a_2 and may take apple a_3 *whatever the reprehensibility relation is.* Thus, the permission is predicted to give rise to the free choice inference and this inference cannot be cancelled anymore. The reason is that although the reprehensibility relation '$\leq$' might be such that a world w where only apple a_1 is taken is less reprehensible than the best world v where, for instance, only apple a_2 is taken, this doesn't matter because in that case the possibilities $\langle w, k\rangle$ and $\langle v, h\rangle$ are not '$\leq^*$'-ordered with respect to each other, because $k(x) = a_1$ and $h(x) = a_2$, and thus $k \neq h$.

Just as our analysis of counterfactual donkey sentences suggested a way to solve the problem involving counterfactuals with disjunctive antecedents, our analysis of permission sentences involving existential quantifiers immediately suggests a similar proposal of how to account for the strength of free choice inferences of disjunctive permission sentences. The idea is, of course, that disjunctions are just existential sentences. Let us represent a sentence like 'John takes (apple) a_1 or a_2' by something like '$\exists x[Take(j, x) \wedge (x = a_1 \vee x =$

$a_2)]$'. Notice that this formula has the same truth conditions as the standard representation of the sentence: '$Take(j, a_1) \vee Take(j, a_2)$'. With a dynamic interpretation of the existential quantifier, however, the truth-sets of the two formulas differ, because the assignments involved in the former set, but not the ones in the latter, have the variable 'x' in its domain. This distinction is crucial once we use these truth sets for the analysis of permission sentences. If worlds where a_1 is taken by John to be less reprehensible than the best worlds where a_2 is taken, $P^*_{/Take(j,a_1) \vee Take(j,a_2)/_g}$ contains no worlds where John takes apple a_2. The minimal worlds where $/\exists x[Take(j, x) \wedge (x = a_1 \vee x = a_2)]/_g$ holds, $P^*_{\exists x[Take(j,x) \wedge (x=a_1 \vee x=a_2)]/_g}$, on the other hand, contains not only worlds where John takes apple a_1, but also worlds where John may take apple a_2. Hence, the free choice inference is predicted if the disjunctive permission sentence is represented as $May(j, \exists x[Take(j, x) \wedge (x = a_1 \vee x = a_2)])$ but not if it is represented as $May(j, Take(j, a_1) \vee Take(j, a_2))$.[27]

Remember that according to Kamp's notion of *p*-entailment mentioned in section 2.1, 'You may take the apple' and 'You may take the pear' follow from 'You may take the apple or the pear' only if taking the apple and taking the pear were equally strongly reprehensible. We have seen that this is perhaps too strong an assumption to make. On our new analysis of permission sentences however, both $May(j, \exists x[Take(j, x) \wedge x = a_1])$ and $May(j, \exists x[Take(j, x) \wedge x = a_2])$ are *p*-entailed by $May(j, \exists x[Take(j, x) \wedge (x = a_1 \vee x = a_2)])$, irrespective of the initial ordering relation. This means not only that the free choice inference is predicted to be uncancelable, but also that domain widening of the existential quantifier used in permissions results in a *stronger* permission. Thus, using Kadmon and Landman's analysis of *any* (for both the NPI and the FC reading), we have straightforwardly explained why this item is licensed in permission sentences.

4 Conclusion

The purpose of this paper was rather limited: I wanted to show that we can straightforwardly analyze counterfactual donkey sentences in a fully compositional way, by combining the Lewis/Stalnaker analysis of counterfactuals with standard dynamic semantics. Moreover, I wanted to show that the

[27] Just as for counterfactuals with disjunctive antecedents, this dual reading might be a virtue rather than a vice: the free choice inference involving disjunctive permissions might be cancelled.

main idea behind this analysis also helps us to account for a number of related problems involving disjunctions and the use of *any* in counterfactuals and permission sentences. Of course, having shown that some particular phenomena can be accounted for in a more straightforward way than perhaps realized before in some well-established theories, doesn't save these latter theories from other problems. It is obvious that the Lewis/Stalnaker analysis of counterfactuals, the dynamic analysis of meaning, the performative analysis of imperatives, and the widening analysis of *any* face problems where my suggestions made in this paper are of no help. Fortunately, these problems were not the topic of this paper.[28]

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[28] In a follow up of this paper, though, I will take up some of these problems and propose to analyze Dayal's (1998) modal '*any*' and free relatives like '*whatever*' as counterfactual donkey sentences (in disguise) and compare that with recent analyses of '*any*' like that of Chierchia (ms).

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