

# Analyzing anankastic conditionals and sufficiency modals\*

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This paper consists of two parts. The first part argues that existing accounts of anankastic conditionals make the wrong predictions in scenarios with multiple non-conflicting goals. In order to avoid the problem, I propose that anankastic conditionals are not interpreted relative to every goal, as previous accounts have it, but relative to those goals that are contextually salient. The second part of this paper is devoted to sufficiency modals, that are formed by combining anankastic conditionals with *only*. I claim that the analysis of von Fintel & Iatridou (2005a) isn't adequate, because it fails to predict that sufficiency modals are transitive. I present an alternative analysis that treats *only* as a modal operator.

## 1. Introduction

Anankastic<sup>1</sup> conditionals state that the complement of the modal in the consequent is a *necessary condition* for achieving the goal introduced in the antecedent (von Wright 1963:9-10). Examples of anankastic conditionals are given in (1). For instance, (1a) expresses that unless you go to Nashville, you do not become a country singer.

- (1) a. If you want to be a country singer, you must go to Nashville.
- b. If you want to go to Harlem, you have to take the A train.<sup>2</sup>
- c. You must first empty yourself, if you are to learn anything.

An adequate analysis of anankastic conditionals has to be able to derive the meaning of such sentences compositionally from the meaning of the conditional and the modal. Kratzer's (1981) integrated account of modals and conditionals thus seems a promising candidate for analyzing anankastic conditionals. In her framework, the interpretation of modals is dependent on

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\*This analysis of anankastic conditionals is also presented in a paper I contributed to the proceedings of Sinn und Bedeutung 9. Consequently, this paper partially overlaps with (Huitink 2005).

<sup>1</sup>From the Greek ἀνάγκη which means 'necessity'.

<sup>2</sup>This is Sæbø's (2001) paradigmatic example of an anankastic conditional. It is based on Billy Strayhorn's song 'Take the A train'.

two contextual parameters, the *modal base* and the *ordering source*, and *if*-clauses are treated as devices that restrict the modal base of the (possibly covert) modal in the consequent. But a closer look reveals that Kratzer's semantics fails to provide a straightforward account of anankastic conditionals.

The first attempt to mend Kratzer's framework was made by Sæbø (2001). He proposed that the *if*-clause of anankastic conditionals restricts the *ordering source* parameter, and not, as Kratzer has it, the *modal base*. However, it is not the entire antecedent that should be added to the ordering source, but only what Sæbø calls the 'internal antecedent', i.e. the complement of *want to* or *be to*.

Independently of one another, both von Fintel & Iatridou (2005b) and Penka et al. (2004) discovered that Sæbø's theory makes the wrong predictions in scenarios with inconsistent goals. To overcome this problem, von Fintel & Iatridou propose that the goal described in the *if*-clause functions as the so-called designated goal. The designated goal overrides any conflicting goals that you may have. Penka et al. on the other hand propose that the internal antecedent restricts the modal base, and not, as Sæbø maintains, the ordering source.

In this paper I aim to show that these alternative analyses aren't satisfactory either, because they cannot deal with situations where you have multiple, *non*-conflicting goals. In section 2.4 I present a counterexample to von Fintel & Iatridou (2005b) and Penka et al. (2004). In section 3 I propose that the solution to the problem is that teleological ordering sources only contain salient goals: goals that have been explicitly introduced in the discourse.

As observed by von Fintel & Iatridou (2005a), anankastic conditionals may be turned into conditionals that state that something is a *sufficient condition* of something else if we combine them with *only*.<sup>3</sup> Such constructions are called 'sufficiency modals'. An example is von Fintel & Iatridou's (2).

(2) If you want good cheese, you only have to go to the North End.

The above sentence conveys that going to the North End is a means of getting good cheese, and that going to the North End is relatively easy. Note that (2) does not express that going to the North End is the *only* way of getting good cheese. In other words, it does not state that going to the North End is a necessary condition for obtaining good cheese. This necessary condition reading is expressed by the anankastic conditional in (3):

(3) If you want good cheese, you have to go to the North End.

The main problem that faces an analysis of sufficiency modals is the fact that (2) doesn't imply that (3) is true. This is a problem, since in the literature on *only* it is generally assumed that a proposition containing *only* somehow implies its *prejacent* proposition, i.e. the proposition without *only*. Von Fintel & Iatridou solve this problem by decomposing *only* into a negation and an existential quantifier, and the assumption that the scope of *only* is 'split': the modal scopes

<sup>3</sup>In some languages, for instance in French, sufficient condition is expressed by a necessity modal combined with negation and an exceptive (von Fintel & Iatridou 2005a:3).

(i) Si tu veux de bon fromage, tu n'as qu'à aller à North End.  
if you want good cheese, you not have except go to the North End  
'If you want good cheese, you only have to go to the North End.'

In this paper I will concentrate on the *only*-languages.

over the quantifier, but under the negation. In section 5 I'll present their analysis in more detail. In this paper I object to their analysis because it fails to predict that sufficiency modals are transitive.

This paper is structured as follows. In the next section I evaluate existing analysis of anankastic conditionals. In section 3 I argue that ordering sources only contain contextually salient propositions. After that, I review a competing theory of anankastic conditionals by von Stechow et al. (2004), who claim that such conditionals are counterfactuals. The last section of the paper is devoted to sufficiency modals.

## 2. Previous analyses of anankastic conditionals

### 2.1. Sæbø's analysis

As said in the introduction, Sæbø's (2001) proposal extends Kratzer's doubly relative semantics in order to treat anankastic conditionals. Before presenting his analysis, I'll first introduce Kratzer's framework, and point out why it fails for anankastic conditionals.

In doubly relative semantics, modals are interpreted relative to two conversational backgrounds, the modal base and the ordering source (Kratzer 1981). Kratzer models these parameters as functions that map worlds to sets of propositions. The modal base  $f$  assigns to the world of evaluation  $w$  a set of propositions  $f(w)$  that describes the domain of possible worlds that the modal quantifies over. The ordering source  $g$  restricts the domain even further. It assigns a set of propositions to  $w$  that partially orders the modal base worlds with respect to how close they are to the ideals expressed by  $g(w)$ . The definition of an ordering source induced by a set of propositions  $g(w)$  is

#### (4) Ordering Sources

for all worlds  $w'$  and  $w''$ :

$$w' \leq_{g(w)} w'' \text{ iff } \{p : p \in g(w) \text{ and } w'' \in p\} \subseteq \{p : p \in g(w) \text{ and } w' \in p\}$$

In other words, a world  $w'$  is at least as close to the ideal  $g(w)$  as a world  $w''$  iff all the propositions of  $g(w)$  that are true in  $w''$  are also true in  $w'$ .

Modals quantify over those modal base worlds that are best by the ordering source:

#### (5) Kratzer's Semantics for Modality<sup>4</sup>

- (i) *must*  $p$  is true in  $w$  iff for all  $w' \in \bigcap f(w)$  s.t.  
 $\neg \exists w''$  s.t.  $w'' \leq_{g(w)} w'$ , it holds that  $p$  is true in  $w'$
- (ii) *can*  $p$  is true in  $w$  iff there is a  $w' \in \bigcap f(w)$  s.t.  
 $\neg \exists w''$  s.t.  $w'' \leq_{g(w)} w'$  and  $p$  is true in  $w'$

The modal base and ordering source parameter thus determine which worlds are accessible for quantification. Which propositions are made true by the accessible worlds depends on the kind of modality invoked. For instance, if sentence (6) is read epistemically, the accessible worlds

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<sup>4</sup>I give a simplified version of the definitions under the assumption that there always exist closest worlds (the so-called Limit Assumption, see Lewis 1973:19-21). I'll make this assumption throughout the paper.

make true every proposition that is known in  $w$ . But if, on the other hand (6) is interpreted deontically, the worlds make everything that is commanded in  $w$  true.

- (6) Harry may spend his summer at the Burrow.
- a. (In view of what is known,) Harry may spend his summer at the Burrow.
  - b. (In view of what is commanded,) Harry may spend his summer at the Burrow.

The modal base and ordering source of a given expression are determined in part by its lexical meaning and by its conversational background. For *has to* in (7c),  $f$  is circumstantial, picking out the relevant circumstances in  $w$ , that Harry is a champion, and  $g$  is deontic, containing the school's tradition. Sentence (7c) is true in  $w$  relative to  $f$  and  $g$  iff in all worlds  $w'$  in which Harry is a champion and that correspond most to the tradition, Harry dances in  $w'$ .

- (7) a. According to the school's tradition, the champions and their partners open the ball.  
 b. Harry is a champion.  
 c. Harry has to dance.

The proposal of Sæbø (2001) differs from Kratzer's semantics in its view on *if*-clauses.<sup>5</sup> Kratzer has it that *if*-clauses always restrict the modal base of the modal in the consequent. The material in the *if*-clause is thus treated as a hypothetical fact. But as argued in (Sæbø 2001), such a view of *if*-clauses is problematic for anankastic conditionals. The following scenario illustrates this. Suppose that in the actual world, you want to become an actor. You do not want to hunt tigers. But I do not know that. To become an actor, you must go to Hollywood. To hunt tigers, you have to go to the jungle. In this scenario, it seems that I can felicitously utter (8) and that my utterance is true.

- (8) If you want to hunt tigers, you must go to the jungle.

But Kratzer's theory predicts that it is false. The truth conditions she assigns to the above sentence are

- (9) (8) is true in  $w$  iff  
 in all  $w' \in \bigcap f^+(w)$  s.t.  $\neg \exists w''$  s.t.  $w'' \leq_{g(w)} w'$ , you go to the jungle in  $w'$ ,  
 where  $f^+(w) = f(w) \cup \{\text{you hunt tigers}\}$

Less formally, (8) is true in  $w$  iff you go to the jungle in all those worlds  $w'$  such that you want to hunt tigers in  $w'$  and as much as possible of what you want *in the actual world*, i.e. to be an actor, is true in  $w'$ . Clearly, (8) comes out false, because in the worlds that are best by  $g(w)$ , you will go to Hollywood. Consequently, you will not go to the jungle in all the best worlds.

To get the truth conditions right, Sæbø proposes that the *if*-clause adds a proposition to the *ordering source*. He thus treats the *if*-clause as a hypothetical ideal, instead of a hypothetical fact. For (8) the initial modal base is circumstantial, specifying all the relevant circumstances about wild life, climate, geography etc. The ordering source is teleological, containing your goals. To this ordering source, the internal antecedent, i.e. the proposition that you hunt tigers is added. Note that the external antecedent, i.e. the proposition that you *want* to go to Harlem

<sup>5</sup>Sæbø (2001) draws on a much earlier manuscript Sæbø (1986).

is not added to the ordering source, since this would have the effect that you want what you want. Sæbø doesn't interpret 'want' but as a signal as to which kind of modality is invoked by the modal in the consequent. The following truth conditions are assigned to (8).

- (10) (8) is true in  $w$  iff  
 in all  $w' \in \bigcap f(w)$  s.t.  $\neg \exists w''$  s.t.  $w'' \leq_{g^+(w)} w'$ , you go to the jungle in  $w'$ ,  
 where  $g^+(w) = g(w) \cup \{\text{you hunt tigers}\}$

Now (8) comes out true. According to Sæbø's semantics the sentence is true iff you go to the jungle in all circumstantially accessible worlds where your goal of going hunting is satisfied. Hence, in the scenario sketched above, (8) is true.

## 2.2. Von Fintel & Iatridou's designated goal analysis

Von Fintel & Iatridou (2004b) argue that Sæbø's theory doesn't fare better than Kratzer's. And they are right. Sæbø makes the wrong predictions in the so-called Hoboken scenario.<sup>6</sup> Suppose that in  $w$  you want to go to Hoboken. But I do not know that. The only way to Hoboken is the PATH train. The only way to Harlem is the A train. I correctly utter (11).

- (11) If you want to go to Harlem, you must take the A train.

Intuitively, (11) is true. but Sæbø predicts that it is false. The modal base for (11) is circumstantial, containing the relevant facts concerning the railroad system, schedules, geography, etc. The ordering source is teleological. Under Sæbø's analysis, your goal of going to Harlem is added to the initial ordering source, which contains what you want in the actual world: going to Hoboken. Sentence (11) is true iff in all modal base worlds  $w'$  that correspond most to what you want, you take the A train in  $w'$ . The problem is that going to Harlem and going to Hoboken are inconsistent goals, so that you can only realize one of your goals. It follows that modal base worlds in which you go to Hoboken are just as ideal as modal base worlds in which you go to Harlem. So it won't be true that you take the A train in all ideal worlds, since in some of them, you take the PATH train.

Von Fintel & Iatridou (2004b) discuss three possible ways to solve the Hoboken problem. In the end, they decide to go with the designated goal analysis. This analysis postulates that in anankastic conditionals the hypothetical goal overrides any conflicting goals that you actually have (von Fintel & Iatridou 2005b:5). The goal expressed in the *if*-clause then figures as the *designated goal*: the only relevant goal in evaluating the conditional. The main idea is that the ordering source that is obtained by intersecting the hypothetical goal  $p$  with the initial ordering source  $g(w)$  is further revised to make it consistent.

The designated goal approach makes the right predictions for the Hoboken scenario. Sentence (11) comes out true, since we just don't take your goal of going to Hoboken into consideration. The modal base worlds are only ranked with respect to your ideal of going to Harlem

<sup>6</sup>The Hoboken scenario is invented by von Fintel & Iatridou (2005b). Penka et al. (2004) offer a different counterexample to Sæbø's theory: the mayor scenario. Since both scenarios point out the same deficiency, I limit myself to the Hoboken scenario.

because this is the designated goal. The ideal modal base worlds thus are worlds in which you go to Harlem. In those worlds you do take the A train.

### 2.3. Penka, Krasikowa & von Stechow: modal base restriction

Penka et al. (2004) propose an alternative solution to the problem from which Sæbø's theory suffers, i.e. the problem of scenarios with inconsistent goals. They claim that in the case of anankastic conditionals the internal antecedent proposition restricts the *modal base* of the modal in the consequent, figuring as a hypothetical fact.<sup>7</sup>

#### (12) Modal Base Restriction

An anankastic conditional *if want p, then must q* is interpreted relative to a circumstantial  $f^+$  and a teleological  $g$ , where  $f^+ = f(w) \cup \{p\}$

This semantics also avoids the Hoboken problem. Sentence (11) is true iff you take the A train in all modal base worlds, i.e. worlds in which you go to Harlem, that are best by the ordering source. The ordering source contains the goal that you actually have: going to Hoboken. But this doesn't pose a problem, since the ordering source orders the modal base worlds. The modal base is already restricted to worlds in which you go to Harlem, and thus the worlds in which your goal of going to Hoboken is reached are not accessible.

The analysis of Penka et al. (2004) is essentially the same as the one proposed by von Fintel & Iatridou (2005b). If the designated goal in the *if*-clause overrides any conflicting goals, it behaves as if it were a hypothetical fact. Recall that in Kratzer's framework the modal base has priority over the ordering source if the latter contains propositions that are inconsistent with the former. A proposition is a necessity iff it is true in all worlds in which all of the modal base propositions are true, and as much of the ordering source propositions *as possible*. So von Fintel & Iatridou ultimately claim that the designated goal has the same sort of priority as the propositions in the modal base.

Because the designated goal analysis and the modal base restriction account do not differ from one another, they both face the same problem. In the next section I'll present a scenario that is problematic both for the proposal by von Fintel & Iatridou (2005b) and the account of Penka et al. (2004).

### 2.4. The Ruud van Nistelrooy problem

Both von Fintel & Iatridou (2005b) and Penka et al. (2004) are able to handle scenarios with inconsistent goals. But they make the wrong predictions in scenarios with multiple consistent goals. The following scenario, which I dub the Ruud van Nistelrooy<sup>8</sup> scenario, should make this clear. Imagine that there are two trains going to Harlem in  $w$ , the A train and the B train. I

<sup>7</sup>This analysis is based on von Stechow (2004b).

<sup>8</sup>Ruud van Nistelrooy is the star of the Dutch soccer team. For more information on Ruud (and pictures), see <http://www.manutd.com/bio/bio.sps?iBiographyID=3328>

ask you about ways to get to Harlem, and you answer by uttering (13). Your utterance is false, since taking the A train is not the only way to get to Harlem.

(13) If you want to go to Harlem, you must take the A train.

But now suppose that in the actual world, I have more goals than just going to Harlem. Suppose that I want to kiss my idol, Ruud van Nistelrooy, and that Ruud happens to be on the A train. Intuitively, the utterance in (13) is still false. But von Fintel & Iatridou predict that it is true.

According to von Fintel & Iatridou, (13) is interpreted relative to an ordering source  $g^+(w)$  that contains both my goal of going to Harlem and my goal of kissing my idol. The hypothetical goal does not override my goal of kissing Ruud, because these two goals are not inconsistent. The sentence is true iff I take the A train in all circumstantially accessible worlds  $w'$  in which I get most of what I want. According to  $g^+(w)$  the best worlds are those in which I get to go to Harlem *and* get to kiss Ruud van Nistelrooy. And in those worlds I will take the A train (say I am not shy and will kiss him when I get the chance). Hence, (13) comes out true.

The problem is that under von Fintel & Iatridou's analysis the modal doesn't quantify over *all* worlds in which I go to Harlem, but only over a subset thereof, i.e., worlds in which I go to Harlem *and* kiss Ruud van Nistelrooy. Consequently, the anankastic reading is not obtained, given that if taking the A train is a necessary condition for going to Harlem, you take that train in every (circumstantially accessible) world in which you go to Harlem.<sup>9</sup>

The treatment by Penka et al. (2004), being by and large equivalent to the designated goal analysis, also incorrectly predicts that (13) is true. According to this analysis the goal described in the antecedent, i.e., going to Harlem, is added to the modal base as a hypothetical fact. But even if the modal base is restricted to worlds in which I go to Harlem, the worlds from the ordering source in which I kiss Ruud van Nistelrooy are still accessible. The best worlds will still be worlds in which I go to Harlem and kiss Ruud. In those worlds I'll take the A train, and so Penka et al. fail to predict that (13) is false.

### 3. Analyzing anankastic conditionals

Let's consider where we are now. Suppose that Sæbø is right in that the goal in the *if*-clause restricts the ordering source parameter, so that an anankastic conditional of the form *if want p*,

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<sup>9</sup>Von Fintel & Iatridou actually provide the following truth conditions for anankastic conditionals, and they claim that this semantics doesn't suffer from the Ruud van Nistelrooy problem (von Fintel & Iatridou 2005b:15):

(14) *if p, must q* is true in  $w$  relative to modal base  $f(w)$  iff all the worlds in  $f(w)$  where  $p$  is achieved are  $q$ -worlds

While it is true that this semantics is indeed immune to the Ruud van Nistelrooy problem, two remarks are in order here. First, it is unclear how these truth conditions spell out the 'designated goal analysis' that von Fintel & Iatridou describe and advocate in their paper. Second, if this really is what the designated goal analysis amounts to, it needs further argument. In the above truth conditions *must* is all of a sudden not interpreted relative to a modal base *and* an ordering source parameter anymore, but just relative to a modal base parameter. The question why the interpretation of *must* does not require an ordering source in anankastic conditionals, but does so in other sentences needs to be answered in order for von Fintel & Iatridou's theory to be plausible.

then *must q* is interpreted relative to an ordering source  $g^+(w) = g(w) \cup \{p\}$ . The Hoboken problem and the Ruud van Nistelrooy problem point out that  $g^+(w)$  should be further restricted. The solutions of both von Fintel & Iatridou (2005b) and Penka et al. (2004) restrict  $g(w) \cup \{p\}$  by demanding that it is consistent, where  $p$  has a priority over the other propositions.<sup>10</sup> But, as we've seen, this isn't enough to solve the Ruud van Nistelrooy problem.

In Huitink (2005) I proposed that the Ruud van Nistelrooy problem should be solved by letting the hypothetical goal be the only goal in the ordering source. This semantics correctly predicts that (13) is false, because quantification now ranges over worlds in which I go to Harlem, and you do not take the A train in all those worlds.

(15) Anankastic Conditionals

*if want p, then must q* is true in  $w$  iff  
 for all  $w' \in \bigcap f(w)$  s.t.  $\neg \exists w''$  s.t.  $w'' \leq_{g(w)} w'$   
 $q$  is true in  $w'$   
 where  $g(w) = \{p\}$

The idea behind this was that ordering sources pick up goals that are salient in the context of utterance and assign these to  $w$ , instead of just assigning *all* your goals to the world of evaluation. That is, I depart from the way Kratzer (1981) models ordering sources.

In doubly relative semantics, a teleological ordering source assigns all propositions that are your goals to  $w$ , and this assignment is *independent of the linguistic context*. In a similar fashion, juridical ordering sources are assumed to contain *all* propositions that the law provides, and a deontic ordering sources consist of *all* propositions that are considered to be good. This line of thinking is followed by von Fintel & Iatridou (2005b) and Penka et al. (2004), and it is because of this concept of ordering source that their theories run into trouble. In evaluating (13), it is always the case that my goal of kissing Ruud makes it into the ordering source, it interferes with my hypothetical goal of going to Haarlem, and the wrong truth value comes out.

But there is an alternative view on ordering sources. In implementations of Kratzer's framework in dynamic semantics, we find that the ordering source just is a contextually salient (set of) proposition(s). In Frank (1997) for instance, the ordering source parameter is treated as an anaphor that needs to link up to a context referent in the previous discourse. These ideas are already present in the system of Geurts (1995).<sup>11</sup> The difference with Frank's system is that in Geurts' system, the antecedent of the anaphor is a propositional referent and not a context referent.

The analysis of anankastic conditionals, and in particular the Ruud van Nistelrooy scenario, brings to light that these two ways of construing ordering sources are not equivalent. On the first view, a teleological ordering source assigns all your goals to  $w$ , whether it is known that these are your goals or not. As a result, (13) is incorrectly predicted to be false. But under the second view, the ordering source only contains those goals that have been explicitly introduced in the conversation. Because of that, we may assume that in the Ruud van Nistelrooy scenario, my goal of meeting my idol is not picked up by the ordering source parameter, and hence will

<sup>10</sup>Of course, the analysis of Penka et al. is stated in different terms, but as seen in section 2.4, their analysis is equivalent to the one by von Fintel & Iatridou.

<sup>11</sup>The material of Geurt's (1995) dissertation is published in Geurts (1999).

not influence the interpretation of the modal in (13).

The anankastic reading thus results from binding the ordering source parameter to the proposition in the antecedent that describes the goal. Introducing a goal in the antecedent of a conditional is a way of making that goal highly salient. Support for this claim can be found in Bittner (2001) where it is argued that *if*-clauses are topical.

Unfortunately, this analysis faces a problem. Von Stechow et al. argue that I have to require that the internal antecedent is compatible with the modal base. If I do not, my analysis makes the wrong predictions. A case in point is (16).

(16) If this water is to boil, its temperature ought to be 100° Celsius.

Assume that in the actual world this water does not boil, and that the modal base contains this fact. The internal antecedent, that the water does boil, is added to the ordering source. The modal in the consequent quantifies over those modal base worlds that are best by this ordering source. In this example, none of the modal base worlds is best by the ordering source. Thus quantification ranges over all worlds in which the water doesn't boil. Obviously, it won't be true that in all these worlds its temperature is 100° Celsius, and so (16) is incorrectly predicted to be false.

Von Stechow et al. point out that if I indeed have to require that the hypothetical goal is consistent with the modal base, my analysis seems to ignore the very reason why Kratzer introduced the ordering source parameter in the first place. Initially, Kratzer (1977) assumed that modals are interpreted relative to just one conversational background, the modal base  $f(w)$ . This turned out to be problematic in case  $f(w)$  is inconsistent, since any proposition is a necessity relative to an inconsistent modal base, and no proposition is a possibility. To solve the problem, Kratzer (1981) proposed that modals are interpreted relative to two conversational backgrounds, the modal base and the ordering source. The modal base contains propositions that describe facts, and the ordering source describes ideals. It may be that the ordering source is inconsistent with the modal base. But if it is, the semantics is so designed that the modal base has priority over the ordering source. A proposition is a necessity if it is true in all the modal base worlds that correspond to the ideals *as much as possible*.

My answer to this objection is that my system does allow for a conflict between the modal base and the ordering source. An example is the mayor scenario of Penka et al. (2004). In this scenario it is given that you want to become mayor and that you do not want to go to the pub regularly. But unfortunately for you, the world is such that you can only become mayor if you do go to the pub regularly. I predict that for (17), the modal base contains the fact that you cannot realize both your goals, and the ordering source contains both the above mentioned goals. Consequently, (17) is false, since you do not go to the pub in all the worlds that are best according to this ordering source.

(17) You have to go to the pub regularly.

But I also predict that (18) is true, since there the ordering source parameter is bound to the goal described in the *if*-clause, under the assumption that a goal in an *if*-clause is highly salient:

(18) If you want to become mayor, you have to go to the pub regularly.

So I do not postulate that the ordering source has to be consistent with the modal base. But this still doesn't change the fact that I predict (16) to be false, when it is actually true. However, as I see it, the wrong predictions for (16) do not depend on my theory that the internal antecedent is the only proposition in the ordering source. This problem rather concerns the *modal base*.

According to Kratzer (1981) there are two basic kinds of modal bases: epistemic ones and circumstantial ones. To appreciate the difference, consider the following two sentences.

- (19) a. In dieser Gegend können Zwetschgenbäume wachsen.  
 in this area can plum trees grow  
 'Plum trees can grow in this area.'
- b. Es kann sein, daß in dieser Gegend Zwetschgenbäume wachsen.  
 it can be that in this area plum trees grow  
 'It is possible that plum trees grow in this area.' (Kratzer 1981:53)

Sentence (19a) has a circumstantial and an epistemic reading, but for (19b) only the epistemic reading is prominent, where the necessity or possibility of a proposition depends on what is known. Supposing that you are traveling in an exotic country and discover that the climate there is appropriate for growing plum trees, (19a) can be true on a circumstantial reading: in view of the climate, plum trees can grow in this area. In the same situation, (19b) may be false, given that it is known that this country has had no contact with plum tree growing communities yet.

So epistemic modals are interpreted relative to everything that we know already. But if we use a circumstantial modal, we are interested in what can or must happen, given circumstances of a certain kind, or, in other words, given certain *relevant facts*. Which facts are relevant is not a clear cut matter.

'When we talk to each other, we hardly ever make explicit in view of which circumstances something should be necessary or possible. We may give hints. Usually people understand. And they all understand in pretty much the same way.' (Kratzer 1981:53-54)

Consider (20). Depending on the situation, I may say quite different things when uttering this sentence. It may mean, for instance, that I don't know how to play the violin. Or suppose that I only have one hand, then (20) may express that I am unable to play the violin due to my physical condition.

- (20) I cannot play the violin.

Let us relate this to sentence (16), von Stechow et al.'s counterexample to my theory. As said, (16) is interpreted relative to a circumstantial modal base, which contains the relevant facts. The question now is which facts are relevant. Clearly, von Stechow et al. assume that because this water doesn't boil in the actual world, this fact has to be added to the modal base. But this is not evident. Intuitively, the modal base should contain facts that are relevant to water's boiling temperature, such as the earth's atmospheric pressure. So that (16) expresses that, given the earth's atmospheric pressure, it is a necessity that if this water boils, its temperature is 100° Celsius. If this were indeed the modal base, and the ordering source would contain the proposition that this water boils, quantification would range over worlds with the same atmospheric pressure as our world and in which this water boils. In all these worlds, the water's temperature will be 100° Celsius, and so (16) comes out true.

Two remarks are in order. First, I do not have a mechanism that determines for any given circumstantial modal the propositions that are in its modal base. It's very hard to give a definition of what a relevant proposition is. Clearly contextual information and world knowledge

affect which propositions are in the modal base, but I do not have a theory on the way people understand circumstantial modality. I can just observe, as Kratzer does, that people usually do. So then how can we be sure that the proposition that the water doesn't boil is not in the modal base for (16)? We cannot be absolutely sure. But we do know that it is irrelevant to the boiling temperature of this water whether it boils in the actual world or not. To me, this makes it plausible that the fact that the water does not boil is not a modal base proposition. That I do not give a principled account of the selection of relevant facts is claimed by von Stechow et al. (2004) to make my analysis virtually empty. So be it.<sup>12</sup>

As an alternative to my analysis, von Stechow et al. propose to analyze anankastic conditionals as some sort of Lewis-counterfactuals, where the accessible worlds are worlds in which the internal antecedent is true and that are maximally similar to the actual world. The second remark I want to make is that though it may seem that under my analysis of (16) quantification ranges over the nearest worlds in which this water boils, this is not the case. The set of nearest worlds in which this water boils is not the same as the set of worlds where the earth's atmospheric pressure is 100.000 Pascal and this water boils. The modal in (16) quantifies over the latter set, which is much larger. In the next section I will present the counterfactual analysis of von Stechow et al. (2004), and point out why it ultimately fails.

#### 4. Anankastic conditionals as counterfactuals

The counterfactual analysis of von Stechow et al. (2004) is based on the observation that anankastic conditionals can be paraphrased by means of purpose constructions (Sæbø 2001). That is, (21a) and (22a) are equivalent.

- (21) a. If I want to be owner of North America, I must find the Golden Helmet.  
b. To be owner of North America, I must find the Golden Helmet.

In addition, von Stechow et al. take anankastic conditionals to be *elliptical* (22a), and they assume that the underlying logical form of a sentence such as (21a) is as in (22b).

- (22) a. If I want to be owner of North America, I must find the Golden Helmet, to do that.  
b. I I want to be owner of North America, [I must [to be owner of North America] find the Golden Helmet]

According to von Stechow et al. the complex main clause of (22b) alone expresses the anankastic reading. The logical form of an anankastic conditional is thus *to*  $\phi$ , *must*  $\psi$ . Following Bech (1957:320ff.) they further assume that purpose clauses have the same function as *if*-clauses: they determine the domain of quantification of the modal in the consequent. So for (21a) the covert *to*-clause provides the domain restriction, and not the overt *if*-clause. Von Stechow et al. argue that the *if*-clause only contributes a felicity condition. They claim that the *if*-clause of

<sup>12</sup>Recently, Nissenbaum (2005) formulated another problem for my analysis: it makes false prediction if the necessity modal in the consequent of the conditional is changed into a possibility modal. Unfortunately, space doesn't permit me to discuss this objection. See however von Fintel & Iatridou (2005b:18-19) for discussion and a possible solution.

an anankastic conditional isn't truly 'conditional', and compare this to other 'non-conditional' *if*-clauses, such as the following.

- (23) If the train is leaving in 2 minutes, why are we standing around here talking?  
(von Stechow et al. 2004:11)

Semantically, von Stechow et al. do not analyze anankastic conditionals as pure Lewis counterfactuals, that are variably strict, but as some sort of strict counterfactuals. If anankastic conditionals were true counterfactuals, their semantics would be as in (24) (Lewis 1973).

- (24) Lewis counterfactuals  
To  $\phi$ , *must*  $\psi$  is true in  $w$  iff  
 $\text{Sim}_w(\phi) \subseteq \psi$

But von Stechow et al. (2004) argue that anankastic conditionals cannot be true counterfactuals, because this would mean that Lewis' *would*-counterfactuals have the same truth conditions as anankastic conditionals. The contrast between (25a) and (25b) shows that this isn't borne out.

- (25) a. If kangaroos had no tails, they would topple over. (Lewis 1973)  
b. For kangaroos to have no tails, they would topple over.

The anankastic conditional in (25b) clearly makes a stronger statement than (25a): it means that the only way to achieve that kangaroos have no tails is that they topple over, which is false. The counterfactual in (25a) on the other hand is true.

According to von Stechow et al. the relation between the antecedent and the consequent of an anankastic conditional is stricter than the relation of a *would*-counterfactual. They propose that an anankastic conditional is true iff the set of most similar worlds where the antecedent is true is a subset of the set of *most similar* worlds where the consequent holds.

- (26) Anankastic Conditionals as Counterfactuals  
To  $\phi$ , *must*  $\psi$  is true in  $w$ , iff  
 $\text{Sim}_w(\phi) \subseteq \text{Sim}_w(\psi)$

This analysis accounts for the falsity of (25b), since it is unlikely that any of the nearest worlds where kangaroos have no tails belongs to the nearest worlds where kangaroos topple over.

Note that under the counterfactual analysis, the Ruud van Nistelrooy problem vanishes. The worlds that the modal quantifies over are the nearest worlds in which the goal of the antecedent is realized. In Kratzer's terminology, the modal in the consequent is interpreted against an empty modal base (that gets restricted with your goal) and a totally realistic ordering source that orders the modal base worlds with respect to how similar they are to the world of evaluation. The modal in the consequent is thus no longer analyzed as a teleological modal, and so the ordering source no longer contains all your goals.

My main objection against the analysis of von Stechow et al. (2004) is that the restriction on the consequent in their final analysis is too strong. Whenever the internal antecedent is false in the actual world  $w$ , but the consequent is true, the analysis of von Stechow et al. predicts that the anankastic conditional is false, whereas such a conditional is intuitively true. Consider

for example (27) and suppose that in  $w$  oxygen is present, but that combustion does not occur. Since oxygen being present is only a necessary condition, but not a *sufficient* condition for combustion to occur, oxygen may be present without combustion occurring. So (27) is true.

(27) If combustion is to occur, oxygen must be present.

According to von Stechow et al. (27) is true iff the nearest worlds in which combustion occurs are included in the nearest worlds in which oxygen is present. But if oxygen is present in the actual world, then the set of nearest worlds where oxygen is present is just the singleton set containing only the actual world:  $\text{Sim}_w(\text{oxygen is present}) = w$ . It follows that the nearest worlds where combustion occurs are not contained in the nearest worlds where oxygen is present, since we are evaluation (27) under the supposition that combustion does not occur in the actual world. So von Stechow et al. predict that (27) is false.

To conclude, the analysis of von Stechow et al. (2004) doesn't capture the meaning of anankastic conditionals correctly. Therefore it is better not to treat them as counterfactuals.

## 5. Analyzing sufficiency modals

### 5.1. Von Fintel & Iatridou's analysis

As said in the introduction, sufficiency modals consist of a necessity modal and an element like *only*. Not all modal auxiliaries can form a sufficiency modal. Only those modals that scope under negation are able to do so. Hence, *need* is fine in such a construction (28a), but *must* is odd (28b), because *need* scopes under negation, but *must* takes wide scope, cf. the contrast between (29a) and (29b).

- (28) a. If you want to be a star, you only need to dress like one.  
 b. \*If you want to be a star, you only must dress like one.

- (29) a. Harry doesn't need to wear dress robes. (NEG > modal)  
 b. Harry must not wear dress robes. (modal > NEG)

von Fintel & Iatridou (2005a:10-14) provide examples from many languages that show that this restriction on modals holds cross linguistically.

The main challenge posed by sufficiency modals concerns compositionality. We would like to derive the meaning of (28a) from the meaning of the anankastic conditional (30) and *only*.

(30) If you want to be a star, you need to dress to like one.

But then we face the so-called *prejacent problem*.<sup>13</sup> In a nutshell, the problem is that (28a) does not imply (30). It is however commonly accepted that a proposition containing *only* implies its *prejacent* proposition. There is much debate<sup>14</sup> about whether this proposition is presupposed,

<sup>13</sup>The term *praeiacens* 'prejacent' was introduced by Medieval scholars. See Horn (1996) for references to the relevant sources.

<sup>14</sup>A recent contribution to the discussion is made by Geurts & van der Sandt (2004), who propose that the prejacent is entailed by the (weak existential) presupposition and assertion of utterances containing *only* taken together. An alternative view is defended by van Rooij & Schulz (2005), who argue that the prejacent is implicated.

entailed or implicated, but it is commonly accepted that an utterance of (31a), among other things, conveys that (31b) is true.

- (31) a. Only Harry likes Hermione.  
b. Harry likes Hermione.

This isn't borne out for sufficiency modals. An utterance of (30) excludes the possibility of becoming a star without dressing like one, whereas (28a) is compatible with there being many ways of becoming a star.

To solve the preajcent problem, von Stechow & Iatridou (2005a:23-31) assume that *only* means something like *nothing other than* and that it is lexically decomposed into two elements, a negation and an existential quantifier, and that these two elements may take different scope positions. If they do, the scope of *only* is split. They argue that this is the case for sufficiency modals: the modal verb scopes under the negation, but over the existential quantifier.

- (32) a. only have to VP  
b. negation > modal >  $\exists$  something other than [VP]

Sufficiency modals are thus treated as an instance of a larger phenomenon which is known as 'negative split'. The literature on this phenomenon mainly focuses on German and Dutch negative determiners, for which it is argued that a lexical decomposition approach is needed to account for the available readings. For instance, Jacobs (1980) claims that the fact that (33) allows for a split reading can only be explained by assuming that at LF the German determiner *kein* decomposes into a negation and an existential quantifier and that the verb intervenes between those two parts of the determiner (but see de Swart 2000 for an alternative view).

- (33) Hanna sucht kein Buch.  
Hanna seeks no book.  
'It is not the case that Hanna is seeking a book.'

Similarly, it seems that in the following Dutch sentence, given the interpretation indicated in (34), the negative quantifier *niets* 'nothing' splits into a negation that scopes over the possibility operator and an existential quantifier that scopes under it.

- (34) Jan kan niets zien.  
Jan can nothing see.  
'Jan cannot see anything.'

Thus, with respect to sufficiency modals, von Stechow & Iatridou claim that the underlying form for sentence (28a) is as in (35).

- (35) If you want to be a star, NEG have-to [you (do something more than dress like a star)]

The meaning that von Stechow & Iatridou assign (28a) follows directly from the form in (35). The modal quantifies over a set of worlds that is restricted by the *if*-clause. As with anankastic conditionals, the internal antecedent, i.e. the goal in the *if*-clause, is part of the restrictor. In constructions such as (28a) however, the negation outscopes the modal so that (28a) expresses

that in not all of the worlds in which your goal of becoming a star is reached, you do something more than dressing like a star. In other words, (28a) is true iff the proposition that you do not do anything more than dress like a star is true in some worlds in which you become a star.

Decomposition of *only* into a negation operator and a quantifier thus solves the preajacent problem (i.e. that (28a) does not imply (30)), because from the fact that you do not have to do anything more than dress like a star in order to become one, it does not follow that dressing like a star is the only way to become a star. In addition, the negative split of *only* also answers the question why only modals that scope under negation may figure in a sufficiency modal: scope splitting typically occurs across modals that scope under negation.

My main objection to the analysis of von Fintel & Iatridou is that it fails to predict that sufficiency modal constructions are transitive. The argument in (36) is judged valid by every native speaker of Dutch in my department that I consulted. The translation of (36) is as in (37).

- (36) Als je een voldoende wilt halen voor logica, hoef je alleen maar te kunnen afleiden.  
 Als je wilt kunnen afleiden, hoef je alleen maar de vuistregels te kennen.  
 Dus, als je een voldoende wilt halen voor logica, hoef je alleen maar de vuistregels te kennen.
- (37) If you want to pass logic, you only have to be able to do deductions.  
 If you want to be able to do deductions, you only have to know the rules of thumb.  
 Therefore, if you want to pass logic, you only have to know the rules of thumb.

But under the analysis of von Fintel & Iatridou (2005a) sufficiency modals are analyzed as existential quantifiers, for the first premise of (36) ranging over the set of worlds in which you pass logic. In (38) I give the argument schema that von Fintel & Iatridou assign to (36), where  $p$  is the proposition that you pass logic,  $q$  the proposition that are able to de deductions and  $r$  that you know the rules of thumb.<sup>15</sup> This argument scheme is invalid.

- (38)  $\exists w(w \in p \wedge w \in q)$   
 $\exists w(w \in q \wedge w \in r)$   
 $\therefore \exists w(w \in p \wedge w \in r)$

von Fintel & Iatridou's semantics doesn't predict transitivity because it doesn't assign a true 'sufficiency' meaning to the sentences under consideration. According to a true sufficiency semantics, the first premise of (36) conveys that you pass logic in *every* world in which you are able to do deductions, which captures the intuition that if being able to do deductions is a sufficient condition for passing logic, being able to do deductions is a *sure way* to pass the subject.<sup>16</sup>

However, von Fintel & Iatridou do not believe that the sentences in (36) express sufficient condition. They admit that, in their semantics, it doesn't follow from the first premise that being able to do deductions is by itself sufficient for passing logic, but they claim that this is the

<sup>15</sup>In order to keep things easy to read, I left the 'not anything more than'-part of von Fintel & Iatridou's analysis out of the translation. This part is irrelevant to the (in)validity of the argument scheme.

<sup>16</sup>Similar remarks can be found in (von Stechow 2004a), who also adopts the 'philosophical' notion of sufficient condition that says that if  $q$  is a sufficient condition for  $p$ ,  $p$  follows from  $q$ . Von Stechow does not relate this to transitivity though.

correct analysis (von Fintel & Iatridou 2005a:31-32). To support their claim, they provide the following contrast.

- (39) a. If you want to learn what Morris is working on you only have to go to the Stata Center.  
 b. You only have to go to the Stata Center and you will find out what Morris is working on.

Sentence (39b) is what von Fintel & Iatridou call a ‘causal conjunction’. They take it that sufficiency modals may either be formed by combining an anankastic conditional with *only*, or by a causal conjunction construction and *only*. The difference between (39a) and (39b), according to von Fintel & Iatridou, is that (39a) is compatible with you going to the Stata Center without finding out what Morris is working on, while (39b) excludes this possibility. The reason is that in (39a) you’ll have to take some obvious additional steps in order to find out what Morris is working on, for instance asking where Morris is. In (39b) on the other hand, going to the Stata Center will *immediately* cause you to learn what Morris is working on. In other words, (39b) does express ‘pure’ sufficient condition, but (39a) doesn’t.

Von Fintel & Iatridou’s argument fails to convince me. Whether or not there is a contrast between (39a) and (39b) doesn’t seem to be related to the validity of (36), and the validity of (36) is an indisputable observational fact.

In order to derive the validity of (36), I propose that the modal in the first premise of (36) quantifies over *all* worlds in which you are able to do deductions. The corresponding argument scheme for (36) is given in (40), where  $p$  is again the proposition that you pass logic,  $q$  the proposition that you are able to do deductions and  $r$  that you know the rules of thumb. It is easy to see that (40) is valid.

- (40)  $\forall w(w \in q \rightarrow w \in p)$   
 $\forall w(w \in r \rightarrow w \in q)$   
 $\therefore \forall w(w \in r \rightarrow w \in p)$

Given this analysis, the relation of sufficient condition is the *inverse* of the necessary condition relation. Whereas the modal in the anankastic (41a) quantifies over worlds in which you pass logic, the modal in the consequent of (41b) quantifies over worlds in which you are able to do deductions.

- (41) a. If you want to pass logic, you have to be able to do deductions.  
 $\forall w(w \in p \rightarrow w \in q)$   
 b. If you want to pass logic, you only have to be able to do deductions.  
 $\forall w(w \in q \rightarrow w \in p)$

Further note that under this semantics, sufficiency modals do no longer entail their prejacent proposition: (41b) does not entail (41a). So the prejacent problem is solved given a true ‘sufficiency semantics’. And the solution does not appeal to negative split of *only*. In the next section I’ll address the derivation of this meaning for sufficiency modals from the meaning of the modal and the contribution made by *only*.

## 5.2. Only as a modal operator

Since the medievals it is known that *only* and *all* are converses.<sup>17</sup> In modern times such an analysis is proposed by Horn (1996). That is, *Only B A* is semantically equivalent to *All A B*, hence *Only B A* is true iff  $A \subseteq B$ . If *A* and *B* are sets of individuals, (42a) expresses that the set of lawyers is contained in the set of crooks.

- (42) a. Only crooks are lawyers.  
 b. All lawyers are crooks.  
 c.  $\forall x(\text{lawyer}(x) \rightarrow \text{crook}(x))$

As far as I know, it is an open question what kinds of sets *A* and *B* may be. For instance, Beaver & Clark (2003:3) argue that *only* may take sets of events as its arguments.

- (43) a. Sandy only feeds Fido [Nutrapup]<sub>F</sub>  
 b.  $\forall e(\text{feeding}(s, f, e) \rightarrow \text{feeding}(s, f, n, e))$

Taking this one step further, *A* and *B* might even be sets of *possible worlds*, i.e. two propositions. Then, in case the arguments of *only* are sets of worlds, *only* is the inverse of a necessity modal.

Evidence for this position comes from Norwegian, in which it is possible to form a sufficiency modal construction with *only* and a bare verb (von Stechow & Iatridou 2005a:14, fn. 8).

- (44) Hvis du vil til Oslo er det bare aa sette seg paa toget.  
 if you want to Oslo is it only to sit Refl on the-train  
 'If you want to go to Oslo, you only have to get on a train.'

I take it that the modal meaning of (44) comes from the element *bare* 'only'.

A further argument for a modal *only* is that sentences such as (45a) seem to have a modal flavor. The sentence can for instance be interpreted as quantifying over 'typical' worlds, inhabited by 'typical' men. This modal flavor seems to be lacking for the prejacent (45b).

- (45) a. Only men can drive.  
 b. Men can drive.

The main question to address in this section is of course how the meaning of sufficiency modals is derived. Since sufficiency modals do not entail their prejacent proposition, we cannot simply apply the meaning of *only* to the meaning of the corresponding anankastic conditional, in order to figure out the truth conditions for a given sufficiency modal. My point of departure is the following observation. Given that *only* is a modal operator, sufficiency modals contain, at surface form, two universal quantifiers over worlds. But the semantic representation of sufficiency modals intuitively only contains one necessity operator. So the semantic representation of (46a) is (46b).

- (46) a. If you want to get good cheese, you only have to go to the North End.

<sup>17</sup>See for instance Petrus Hispanus' *Tractatus*. Critical edition by de Rijk (1972).

- b.  $\forall w(w \in \{\text{you go to the North End}\} \rightarrow w \in \{\text{you get good cheese}\})$

This suggests, that in sufficiency modals there is a phenomenon often called *modal concord* or modal harmony going on. We speak of modal concord when a clause contains two modal operators, but the meaning of that clause has to be construed using only one such operator (Halliday 1970; Lyons 1977:807). Examples of sentences that allow for a modal concord reading are.

- (47) a. He may possibly have forgotten.  
b. Bert must certainly be in Belgium.

Both (47a) and (47b) contain a modal auxiliary and a modal adverb, but yet, at least on one interpretation, the semantic representation contains only one modal operator. For instance, (47a) means that it is possible that he has forgotten, and not that it is possible that it is possible that he has forgotten. Similarly, the semantic representation of (47b) contains one necessity operator.

As far as I know, there hasn't been much research about the restrictions on modal concord. It does seem clear however that combinations of modals are harmonic (i) if both modals have the same force (possibility of necessity), and (ii) if they are both of the same type (for instance epistemic, or deontic). Thus (48b) and (48a) do not have a modal concord reading.

- (48) a. He may certainly have forgotten.  
b. Perhaps the pink dinosaur may leave.

Sentence (48a) doesn't allow for a modal concord reading because the two modals differ in force. By contrast, modal concord is disallowed for (48b) due to a mismatch in modal type, *perhaps* being epistemic and *may* being deontic.<sup>18</sup>

Now suppose that in sufficiency modals, there is modal harmony between *only* and the modal auxiliary in the consequent. This is why in (46b), the semantic representation of (46a), universal modal force is encoded only once. If this is correct, then it shouldn't be possible to form a sufficiency modal by combining *only* with a possibility operator, since this would exclude a modal concord reading by lack of agreement in modal force. It is indeed impossible for modals with existential force to yield a sufficiency reading (cf. von Stechow & Iatridou 2005a:10). Neither one of (49) and (50) express sufficient condition.

- (49) If you want to get good cheese, you only may go to the North End.  
(50) If you want to kiss Ruud van Nistelrooy, you can only take the A train.

Note that (50) expresses that taking the A train is the only way to satisfy your goal of kissing Ruud van Nistelrooy. In other words, (50) states that taking the A train is a *necessary* condition for kissing Ruud. So, (50) is an anankastic conditional.

Similarly, *should* and *ought* are bad in sufficiency modals, since these modals do not express full necessity, but rather something in between possibility and necessity, such that *should p* means that *p* is true in most accessible worlds. The next two sentences indeed do not express sufficient condition.

<sup>18</sup>Compare the remarks on modal concord by Geurts & Nouwen:16-20.

- (51) a. If you want good cheese, you only ought to go to the North End.  
 b. If you want good cheese, you should only go to the North End.

Additionally, if there's modal concord going on in sufficiency modals, we may expect that there is a restriction on the type of modals that are harmonic with *only*. Epistemic modals should not be able to figure in sufficiency modal constructions. That is, under an epistemic interpretation of *have to*, (52) should be out. And it is.

- (52) If Mary is to be happy, she only has to be in Rome.

So it seems that modals that occur in sufficiency modals have to be goal-oriented. But not all goal-oriented modals form such constructions. Only those that may scope under negation do. This I take to be independent of the phenomenon of modal concord though.

To sum up, it doesn't seem to be utterly implausible that the semantics of sufficiency modals is the result of something like modal concord. So let's assume that even though sufficiency modals contain two necessity operators (*only* and a modal auxiliary), only one of them is encoded in the semantic representation. Then how is this single modal operator to be interpreted? I assume that the arguments of this modal are determined partly by the modal verb in the consequent, so by *have to* in (53), and partly by *only*.

- (53) If you want to get good cheese, you only have to go to the North End.

The modal operator in sufficiency modals takes what would be the arguments of the modal verb in an anankastic conditional and reverses them. In anankastic conditionals, as argued in section 3, the domain of the modal is restricted by the goal described in the antecedent. We may thus view anankastic conditionals of the form *if want p, then have to q* as expressing that all *p*-worlds are *q* worlds.

- (54) a. If want *p*, have to *q*  
 b.  $\forall w(w \in p \rightarrow w \in q)$

*Only*, being a reverse necessity modal, takes exactly these arguments, but reverses their relation: all *q*-worlds are *p*-worlds.

- (55) a. If want *p*, only have to *q*  
 b.  $\forall w(w \in q \rightarrow w \in p)$

Note once more that under this analysis sufficiency modals are the *mirror image* of anankastic conditionals, and that sufficiency modals are thus not predicted to entail their preadjacent anankastic conditional.

To conclude, I have argued that sufficiency modals are transitive, and that this property falls out if they are analyzed as the mirror image of anankastic conditionals. This analysis also solves the preadjacent problem. I have tried to make it plausible that the sufficiency reading results from modal harmony between the modal in the consequent, and *only*, which I have proposed to analyze as a modal operator. I cannot claim to have given a full theory, the modal concord story is to be considered a sketch of an idea. There is still a lot to be investigated, in particular on modal concord and its restrictions across different languages. This is something for future

research. Another issue left to be addressed is why only those modal verbs that scope under negation are able to form a sufficiency modal. At the present moment, I cannot answer that question.

## 6. Conclusions

I have presented an analysis of anankastic conditionals that is able to deal with scenarios in which you have multiple consistent goals. Such scenarios can only be dealt with if anankastic interpretations are sensitive to the goal that is described in the antecedent only. I have argued that this can be made plausible if we adopt the dynamic view on ordering sources, according to which ordering sources are salient sets of propositions.

Additionally, I have proposed that sufficiency modals are, semantically, the mirror image of anankastic conditionals. The element *only* in such constructions has to be analyzed as a modal expression and the sufficiency reading results from modal harmony between *only* and the modal verb. The analysis presented predicts that sufficiency modals are transitive, and solves the preadjacent problem.

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