

ANANKASTIC CONDITIONALS

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1. PLOT¹

The object of our investigation is expressing necessary condition in natural language, particularly in a certain kind of conditional sentences, the so-called anankastic conditionals (ACs). We will propose a very simple analysis, which is novel to the best of our knowledge.

The first extensive discussion of the ACs is due to (Sæbø, 1986), who discovered that these conditionals are reluctant to a standard modal treatment. A number of recent papers on this topic refreshed linguistic interest in this phenomenon and motivated further research in the semantics of modality. To illustrate the problem, let us look at the sentences we will focus on:

- (1) a. You have to take the A train if you want to go to Harlem.
b. If you don't take the A train you can't go to Harlem.
c. To go to Harlem you have to take the A train.

This paradigm was brought into light by (Sæbø, 1986), who followed (Bech, 1955/57) in assuming the equivalence of the conditional in (1a) and the infinitival construction in (1c). The conditionals in this list are called "anankastic"², a term due to (Hare, 1971). They have

¹ We wish to thank Orin Percus, Sigrid Beck and Wolfgang Klein for inspiring discussion of the topic. It is obvious that we owe crucial insights to the authors quoted in this study; a warm thanks to them.

² From Greek *anagkê* „necessity“.

the special property that the truth of the consequent is the only way that guarantees the truth of the antecedent. Or, the consequent is a necessary condition for the truth of the antecedent. While Hare had in mind constructions like (1a), a better construction to make the semantics clear is (1c) with the infinitival clause “you to go to Harlem” as antecedent A and the matrix clause “you take the A train” as consequent C. The truth of C is the only way to entail the truth of A.

Deriving the semantics of (1a) in a compositional manner has proved to be a challenging task, the main difficulty being the treatment of the bouletic modal in the antecedent of the conditional.

Most of the existing approaches are based on the theory of conditionals developed in (Kratzer, 1981) that assumes two parameters for the interpretation of modals – a realistic modal base and a not necessarily realistic ordering source (e.g. teleological or deontic).

The first attempt to give an appropriate semantics for conditionals like (1a) is due to (Sæbø, 1986). Sæbø assumes that the antecedent without *want to* (called “internal antecedent”) is added to the ordering source, not to the modal base. Normally an antecedent of a conditional is added to the modal base in Kratzer’s theory.

Recently, (Stechow et al., 2004) and (Fintel and Iatridou, 2004) have argued independently that Sæbø’s analysis predicts wrong truth conditions for some anankastic conditionals. Both critiques contain proposals that are supposed to overcome the shortcomings of Sæbø’s proposal.

(Fintel and Iatridou, 2004) develop an analysis that treats the internal antecedent as a *designated goal* that can override any other goals standing in its way.

(Stechow et al., 2004) solve the problem by letting the internal antecedent restrict the modal base, thus treating it as a hypothetical fact and ignoring the contribution of *want*.

Both of the latter accounts have been criticised in (Huitink, 2004). They obtain a wrong result if the goal expressed by the antecedent is compatible with another goal in the ordering source.

Huitink’s proposal is to treat the ordering source as provided by the antecedent only. This trivialises the idea of an ordering source almost completely. The antecedent worlds are the ideal worlds and the non-antecedent worlds are not ideal. The account amounts to a simple strict conditional: the internal antecedent is added to a contextually given modal base and the consequent has to follow from that. If we restate the analysis in this way it becomes clear that the ordering source doesn’t play any role for the determination of the truth condition. The only thing that matters is the internal antecedent. Additional information in the orderings source can yield an intuitively wrong truth condition.

These considerations lead us to the view that one should reconsider the entire analysis. We will treat the anankastic conditional as a Lewisian counterfactual with the complement of the *want*-proposition as antecedent. This will account for all the problems that have been discussed in the literature. An advantage of the theory will be that it says precisely what the modal base of an AC is in each particular case, namely all facts that hold in the next antecedent worlds. The previous modal theories remain silent about the question of what is in the modal base.

Our proposal starts from the observation by (Fintel and Iatridou, 2004) that anankastic conditionals with a *want*-clause as antecedent are elliptical. More explicit versions of the Harlem example are these:

- (2) a. If you want to go to Harlem, you have to take the A train to do this.
 b. If you want to go to Harlem, you have to take the A train to go to Harlem.

The important task consists in finding a semantics for the main clause, which is a conditional with a purpose clause as antecedent and which contains no “want”. In a first step we propose that it means:

- (3) The nearest worlds where you go to Harlem, are contained in the worlds where you take the A train.

The *if*-clause, containing “want”, is not the antecedent of the conditional. Its role is to add a further condition, which does not have much impact on the truth condition of the sentence, if any impact at all.

The analysis given in (3) is presumably not the entire story for it doesn’t express the intuition that the consequent is a means for achieving the goal expressed in the antecedent. We have tried to strengthen the anankastic relation, but we haven’t succeeded. But competing proposals are not better in this respect it seems to us.

The structure of the paper is as follows. In section 2 we will have a closer look at the data, section 3 will be a review of what has been said in the literature with regard to the meaning of anankastic conditionals and in section 4 we will present a counterfactual account.

2. WHAT IS AN ANANKASTIC CONDITIONAL?

Conditionals of the form (1a) are called anankastic conditionals³. This is a sort of conditionals with the consequent expressing necessary condition for achieving the goal or wish expressed by the antecedent. Thus, the *if*-clause always has a bouletic/teleological modal expression and the matrix clause an explicit necessity operator. Here is an example from (Bech, 1955/57):

- (4) Wenn Müller mit Schmidt verhandeln will/soll, muss er nach Hamburg fahren.
‘If Müller wants/is to negotiate with Schmidt he has to go to Hamburg’

Sentence (4) means that the only way for Müller to negotiate with Schmidt is to meet him in Hamburg. Note that this paraphrase ignores the contribution of “want” to which we will return below.

This is the most natural interpretation though not the only one. Such conditionals are not bound to have the anankastic interpretation. Compare the following pair of sentences from (Hare, 1971):

- (5) a. If you want sugar in your soup, you should ask the waiter.
 b. If you want sugar in your soup, you should get tested for diabetes.

Whereas (5a) shows all the symptoms of being an anankastic conditional, (5b) would sound weird on this reading. Rather, it is a normal *must*-conditional sentence saying that in view of the medical facts, in any situation in which you want sugar in your soup and respect the speaker’s advice you get tested for diabetes. (4) patterns with (5a) and it would be difficult to make up a scenario in which it could be interpreted as a normal conditional like (5b).

The presence of *want/be to* in the antecedent is obligatory if one wants to obtain the anankastic reading, but as (Sæbø, 2001) accurately observes, the subject of *want* must corefer with the subject of the matrix clause for the anankastic reading to obtain. In the following group of examples (6b) is not an anankastic conditional in contrast to (6a) and (6c).

- (6) a. If David is to recover we must find him a maid.

³ The term is due to (Wright, 1963).

- b. If David wants to recover we must find him a maid.
- c. If we want David to recover we must find him a maid.

This requirement on coreference/disjoint reference suggests that *want/be to*, whatever their semantic contribution is, see to it that the necessary referential relations are established. So the presence of these modals is essential for the reading to be available and their role has to be explicated in the analysis.

Another important observation in (Sæbø, 2001) links anankastic conditionals to various kinds of purpose constructions. The idea is due to the Danish scholar Gunnar Bech, who uses anankastic conditionals to paraphrase a certain class of German *to*-infinitival constructions he calls “determinative” (Bech, 1955/57:102). Here the *to*-clause (or the German *um*-clause) restricts the modality; it provides the range of worlds over which the universal quantifier expressed by the modal “must/muss” quantifies. Thus, (4), which we repeat below in (7a), is a paraphrase of (7b) on its anankastic reading:

- (7) a. Wenn Müller mit Schmidt verhandeln will/soll, muss er nach Hamburg fahren.
 ‘If Müller wants/has to negotiate with Schmidt he has to go to Hamburg’
- b. Müller muss nach Hamburg fahren, um mit Schmidt zu verhandeln.
 ‘Müller has to go to Hamburg to negotiate with Schmidt’

Indeed, the sentences in (7) seem to express the same meaning, namely, that the complement of *must* is the necessary condition for the truth of the proposition ‘*Müller negotiates with Schmidt*’. (Bech, 1955/57) observes that sentence (7b) has a non-anankastic interpretation as well. The *to/um*-clause may express a “normal” purpose clause, which has a causal meaning. Under this interpretation (7b) means something like: “Müller must to travel to Hamburg because he wants/is obliged to negotiate with Schmidt”. The purpose interpretation has nothing to do with modality. Indeed, we can omit the modal and still obtain a purpose reading:

- (8) Müller travels to Hamburg to negotiate with Schmidt.

Anankastic conditionals have a “contraposed” paraphrase:

- (9) Wenn Müller nicht nach Hamburg fährt, kann er nicht mit Schmidt verhandeln.
 ‘If Müller doesn’t go to Hamburg he can’t negotiate with Schmidt’
- (10) Müller kann nicht mit Schmidt verhandeln, ohne nach Hamburg zu fahren.
 ‘Müller can’t negotiate with Schmidt, without going to Hamburg’

(9) and (10) are equivalent with (7) or at least entailed by it. The semantics for anankastic “must/have to” should account for this meaning relation.

A note to the terminology. Following common practice, we conceive of the *if*-clause of a conditional as the restriction of an overt or covert modal. The *if*-clause is called the antecedent of the conditional and the modalised proposition or property is called consequent of the conditional. In (9), the antecedent is “if Müller doesn’t go to Hamburg”, and the consequent is the infinitival “he not negotiate with Schmidt”. The modal “can” expresses the logical relation between the two. In the example given, the entire construction is negated in addition. We extend the terminology to modals that are modified by “*um/to*”-clauses. For instance, (7b) is a conditional with the antecedent “to negotiate with Schmidt” and the consequent “Müller to go to Hamburg”. The two are mediated by the anankastic modal “must”.

To summarize this section. An anankastic conditional consists of a modal “must/have to”, which is either restricted by an *if*-clause containing an expression of intention or obligation or by a *to*-clause. This restriction is the antecedent of the conditional. The restriction expresses a goal of the subject. The entire construction expresses the idea that the

consequent has to be true if the goal is to be true. The construction has a *can*-variant. Then it means that the goal cannot be true without the consequent being true. The construction must not be confused with normal purpose constructions, which have a different meaning.

3. PREVIOUS ANALYSES OF ANANKASTIC CONDITIONALS

In this section we give an overview of approaches to analysing anankastic conditionals. Since (Sæbø, 1986) the goal has been to develop an adequate analysis for this curious kind of conditionals within the theoretical framework of (Kratzer, 1981), the most popular theory for modals and conditionals. (Fintel and Iatridou, 2004) and (Stechow et al., 2004) refuted Sæbø's analysis by independently showing that it fails in the face of inconsistent goals. Their solutions have been criticized in a more recent account in (Huitink, 2004) who discusses certain scenarios with consistent goals and considers them problematic for the former two accounts. By doing this she brings up an important property of anankastic constructions – a restricted notion of necessary condition.

Let us look at these analyses in detail and see what lessons we can draw from them.

3.1. Sæbø's Analysis

Sæbø was the first to identify anankastic conditionals as problematic data for (Kratzer, 1981). According to Kratzer, the two contextual parameters for the interpretation of modals are the realistic modal base and the ordering source, f and g respectively. f and g are defined as sets of propositions⁴. f determines accessible worlds that are further restricted by g . $g(w)$ contains goals, wishes, regulations that are used to order accessible worlds according to how many of those they make true.

(11) Ordering relations⁵:

Let g be an ordering source and let u, v, w be worlds:

$v <_{g(w)} u$ iff $\{p \in g(w) : p(u)\} \subset \{p \in g(w) : p(v)\}$

The *if*-clause of indicative conditionals restricts the modal base in the sense that $H(w)$ is intersected with the proposition it expresses.

If we apply this semantics to the anankastic conditional in (12), we predict that it is true in w with respect to f and g iff the condition in (13) holds:

(12) If you want to go to Harlem you have to take the A train.

(13) $(\forall w' \in f(w))$ you want to go to Harlem in w' & $(\neg \exists w'' \in f(w))$ you go to Harlem in w'' & $w'' <_{g(w)} w' \rightarrow$ you take the A train in w'

where $f(w)$ contains relevant facts, e.g. train schedules, and $g(w)$ is a set of your goals/wishes in w .

Condition (13) states that the sentence is true iff in all accessible worlds which make as many of your goals true as possible and in which you want to go to Harlem, you take the A train. This fails to capture the intuitive meaning of (12), as Sæbø correctly observes. This is so for the following reason: It is a fact that you go to Harlem only if you take the A train. It is not a fact that you want to go to Harlem only if you take the A train.

⁴ The propositions in f must be consistent, therefore it is possible to treat $f(w)$ as a set of worlds. We will follow this practice in the rest of the paper.

⁵ We assume a simplified definition of the ordering source due to Irene Heim (lecture notes) that presupposes the Limit Assumption.

To remedy Kratzer's analysis Sæbø suggests that it is the ordering source that grows as a result of processing the *if*-clause, not the modal base. *Want* in the *if*-clause is a kind of indicator that the internal antecedent (the complement of *want*) is added to the ordering source and the modal base is not extended by a hypothetical fact, as is the case with ordinary conditionals.

Thus, Sæbø's revised semantics for conditionals consists of two clauses - the first one applies to normal conditionals, the second takes care of the anankastic ones:

- (14) (Sæbø, 2001:442)
- $\| (if \alpha) ((must)) \|^{f;g} = \| must \|^{f^+;g^+}$ where if α expresses φ then for any w ,
- (i) $f^+(w) = f(w) \cup \bigcap_{v \in \varphi} F(v)$ and $g^+(w) = g(w)$
 where F is the general modal base ('the facts', 'what is the case'), **or**
 - (ii) $f^+(w) = f(w)$ and $g^+(w) = g(w) \cup \bigcap_{v \in \varphi} G_\alpha(v)$
 where G_α is the ordering source expressed in α (e.g., 'what you want').

The idea behind the qualification (i) is that $\bigcap_{v \in \varphi} F(v)$ is supposed to be φ , the external antecedent, and this proposition is added to the modal base $f(w)$ for non-anankastic conditionals.⁶

The qualification (ii) for anankastic conditionals is best understood by considering the standard example (1). G_α is the information "you want". $\bigcap_{v \in \varphi} G_\alpha(v)$ the set of propositions that are true in every world where you want to go to Harlem. Presumably, this set contains the proposition 'you go to Harlem' and every proposition entailed by it. This set is added to the ordering source $g(w)$.

The first problem of arising with this analysis is that it is not compositional. There is no systematic procedure the information G_α is obtained from the antecedent.

The second problem is that Sæbø underestimates the complexity of the ordering source and the role of the internal antecedent as a hypothetical fact. To show why it is enough to construct a scenario where the goal expressed in the antecedent is in conflict with the real goals of the subject. In this case, the conditional comes out false under Sæbø's account, which should not be the case.

One such scenario for sentence (12) is discussed in (Fintel and Iatridou, 2004) under the title 'The Hoboken Problem':

- (15) The Hoboken Scenario
- a. You want to go to Hoboken.
 - b. Harlem and Hoboken are conflicting goals, e.g. for time reasons you can't visit both places on one day.
 - c. The PATH train goes to Hoboken.
 - d. The A train goes to Harlem.

F&I correctly observe that if (12) is uttered in a situation like (15) Sæbø's analysis fails. According to Sæbø's account, the sentence is true iff in all the best worlds you take the A train. The best worlds are the Harlem worlds and the Hoboken worlds. But it does not follow from the relevant facts that you take the A train if you go to Hoboken. So you don't take the A train in all the best worlds. There are some worlds in which you take the PATH

⁶ We don't quite understand where the F comes from. A more transparent way would be to say that φ is added to the modal base $f(w)$.

train, viz. the Hoboken worlds. Therefore the conditional is false, which is a wrong prediction. (Stechow et al., 2004) brought up the same point independently by discussing the following sentence from (Kratzer, 1981: 315):

- (16) If you want to become the mayor, you must go to the pub regularly.
- (17) The mayor scenario
- a. You want to become the mayor.
 - b. You don't want to go to the pub regularly.
 - c. You become the mayor only if you go to the pub regularly.

If we follow Sæbø and add the proposition “you become the mayor” to $g(w)$ without any restriction of the modal base, we get the same problem again. The sentence is incorrectly predicted false, because there are best world in which the consequent does not hold, viz. the worlds where (17b) is fulfilled.

3.2. von Stechow's analysis

In his lecture notes from 2003 proposes that the “want” in the antecedent is empty at the logical form. The antecedent is added to the modal base, which is a circumstantial one, i.e., it expresses facts of the actual world. So the internal antecedent plays the role of a hypothetical fact. Since anankastic conditionals have the form of indicative conditionals, the antecedent has to be consistent with the modal base. The analysis can cope with both the Hoboken problem and the Mayor problem. It is not entirely compositional, because the contribution of “want” in the antecedent remains unclear. If the second parameter would be a bouletic ordering source, we would obtain Huitink's problem as well.

3.3. von Fintel and Iatridou's Analysis

(Fintel and Iatridou, 2004) discuss three different solutions of the Hoboken problem. Their final choice is the ‘designated goals’ analysis, which we will discuss in the following (for the critical review of the remaining two alternatives see (Stechow et al., 2004)).

von Fintel and Iatridou are guided by the intuition that the antecedent of an anankastic conditional contributes a „designated goal“ to the semantics. Crucial for them is that there should be a mechanism that makes the proposition expressed by the complement of *want* or by the *to*-clause in the infinitival construction ‘override’ any other goals in the ordering source. Following this idea they suggest that teleological modals are restricted by the designated goal argument. Their proposal is this:

- (18) von Fintel & Iatridou's analysis
- (34) a. *to p, ought to q* is true in w relative to modal base $f(w)$ and ordering source $g(w)$ iff all the $g(w)$ -best worlds in $f(w)$ where p is achieved are q -worlds.
 - b. *to 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.

The goal expressed by the *if*-clause of anankastic conditionals contributes the designated goal by filling the relevant argument slot, since it is contextually salient.

If we consider the Harlem sentence, the designated goals analysis correctly predicts that in all circumstantially accessible worlds, in which your goal to go to Harlem is achieved, you take the A train, which is a welcome prediction.

This analysis is successful in solving the problem with inconsistencies in the ordering source. In fact, the ordering source doesn't play any role for the analysis. However, the claim that the analysis is compositional is not justified. It works no better in this respect than (Stechow et al., 2004). "Want" does not contribute to the meaning of the sentence. At the end of their paper, von Fintel and Iatridou speculate on how the external antecedent could be integrated into the truth condition. One possibility considered is the introduction of a second silent epistemic modal, something like "If you want to go to Harlem MUST [to go to Harlem, must you to take the A train]. Or the if-clause somehow expresses an additional modification of the circumstantial modal base. None of these proposals solves the compositional problem, because "want" is ignored for the essential part of the truth condition, viz. (18) [= (34)].

Note that we cannot see any difference between [34a] and the analysis proposed in (Stechow et al., 2004), except for wording. The designated goal is treated precisely as if it were the antecedent of a conditional with circumstantial modal base and teleological ordering source, i.e., it plays the role of a hypothetical fact.

von Fintel and Iatridou make a further step to make sure that the antecedent is treated compositionally. They allow it to restrict the modal base of the teleological modal.

One of the advantages of von Fintel and Iatridou's proposal is that it distinguishes between *must*-conditionals and weaker *ought*-conditionals. The difference is that the latter are evaluated with respect to the teleological ordering source, whereas for the former the ordering source can be empty. There is one particular feature in the analysis that strikes us as being correct: the authors assume that the main clause of the anankastic conditional is elliptic: the restriction for the modal is determined by the context and perhaps the if-clause itself. We will stick to that idea in the following.

3.4. Huitink's Analysis

(Huitink, 2004) is the most recent attempt to solve the puzzle of anankastic conditionals. Huitink argues that if there are several non-conflicting goals at stake and several ways to achieve the goal in the antecedent, the anankastic reading cannot obtain. So anankastic sentences are false in such cases. However, they can be predicted true under the analysis in (Fintel and Iatridou, 2004). The scenario that should make the argument clear is the following:

- (19) The Ruud von Nistelrooy scenario
- a. To go to Harlem, you can take the A train or the B train.
 - b. You want to go to Harlem.
 - c. You want to kiss Ruud van Nistelrooy (Dutch soccer star).
 - d. Ruud van Nistelrooy is on the A train.

The designated goal analysis would predict that the Harlem sentence is true at least in its *ought*-version:

- (20) If you want to go to Harlem you ought to take the A train.

What we get is that in the best Harlem worlds, i.e. the worlds in which you kiss Ruud van Nistelrooy, you take the A train. This follows from the facts in the described scenario. So the sentence is true but it shouldn't, because the A train is not the necessary condition for going to Harlem in (19).

(Huitink, 2004) raises the same objection against the account in (Stechow et al., 2004).

Here, the same result obtains for (20) as with the designated goal analysis if we admit a non-empty ordering source.

Huitink follows Sæbø in assuming that the internal antecedent of the conditional is added to the ordering source. In view of the possible inconsistencies, she has to make an important modification. She assumes that the antecedent alone constitutes the ordering source. This draws on the idea that the ordering source in contrast to the modal base must be explicitly stated.

Discussion. There are two possible problems with Huitink's analysis. The first is that the internal antecedent has to be consistent with the modal base. Otherwise true anankastic conditionals would be predicted to be false. The compatibility requirement does not follow from the architecture of Kratzer's semantics for modality. The ordering source typically contains propositions that are not compatible with the modal base. The second problem is the question of which relevant facts are in the ordering source. If this question is not answered, the theory is virtually empirically empty.

Problem 1: The internal antecedent has to be compatible with the ordering source.

Assume a situation w in which the proposition $\neg p =$ 'this water doesn't boil' is true. Suppose the modal base includes this fact. The following anankastic condition is false in w :

(21) If this water is to boil, its temperature ought to be 100⁰ Celsius.

The worlds quantified over by the modal are all p -worlds. The goal $\neg p$ cannot be added because it is inconsistent with the modal base. Therefore the truth condition of the anankastic conditional is the following statement, which is false:

(22) In every world where this water doesn't boil and..., its temperature is 100⁰ Celsius.

It has to be explained why it is not possible that a goal is in conflict with this very salient fact and the modal base in general.

Problem 2: Which are the relevant facts in the modal base?

Consider (20) again. There are many ways to go to Harlem. You can take the A train, you can take a taxi, you can ask someone to give you a ride, you can walk all the way through Manhattan, you can pretend to be an emergency and call for the ambulance and so on. In other words, it is not only a fact that you will reach Harlem, if you take the A train. It is a fact as well that you will reach Harlem if you walk through Manhattan and so on. If all of these were equally relevant for the evaluation of the truth of (20), the anankastic conditional would be predicted to be false under Huitink's analysis. So how do we know that of all these facts the only thing that matters is the fact that you will reach Harlem if you take the A train? We think the answer is that taking the A train is the easiest way of going to Harlem. The other ways mentioned are more remote possibilities. So we really need a theory that chooses the least remote possibility among several possibilities. We think that Lewis's theory of counterfactuals does precisely this.

Huitink's conclusions are important in one more respect. She insists on the purely anankastic reading which is not available in scenarios like (19). But anankastic sentences are not always false in such scenarios. Quite often we actually have to deal with pseudo anankastic readings in the sense that we restrict the domain in which the necessary condition holds. We will discuss that point in section 4.10.

We can now look at our task out of a new perspective.

4. A “COUNTERFACTUAL” ANALYSIS

4.1. *Where we are now*

In order to develop an adequate analysis of anankastic conditionals, let us summarize what the previous accounts had to struggle against:

- The hypothetical fact in the antecedent is the most decisive factor in the evaluation. But it is embedded under the bouletic modal, so not directly accessible. If one treats it as a wish/goal, but not as a relevant fact, one has to give it precedence over whatever else is in the teleological ordering source or one has to define the ordering source in a completely new way. (F&I and we contra Sæbø)
- Ranking accessible worlds on the basis of the teleological ordering source is problematic. What is best with respect to your goals is not always what is necessary. (Huitink)

In the next section, we will attack the problem by looking more carefully at the syntactic construction of anankastic conditionals with *if*-clauses that contain “want”. This closer investigation will reveal that the *if*-clause forms no part of the anankastic conditional at all. The consequence will be that we need not find a locus for “want” in the composition of the truth condition.

4.2. *Anankastic Conditionals as Lewis-Counterfactuals*

The idea is simple. Let us assume that we are dealing with a different source of ordering in the case of anankastic conditionals. We rank worlds on the basis of comparative similarity to the actual world, in the sense of (Lewis, 1973b). As with counterfactuals, we restrict accessible worlds to those that are closest to the actual world, i.e. make as many of its facts true as possible. To keep pace with the preceding discussion, we remain in Kratzer’s framework, where a counterfactual is formalized as a modality with an empty modal base and a totally realistic ordering source. f is an empty modal base if $f(w)$ is the necessary proposition W for any world w , and g is totally realistic if $\cap g(w) = \{w\}$ for any w . Formally, the truth condition looks exactly as the semantics that von Fintel and Iatridou state for anankastic “ought” in (18), which is repeated for convenience):

- (23) Anankastic necessity (to be revised)
 to p , *ought to/have to* q is true in w with respect to modal base $f(w)$ and ordering source $g(w)$ iff all the $g(w)$ -best worlds in $f(w)$ where p is true are q -worlds
 (iff all the $g(w)$ -best worlds where p is true are q -worlds)

The $g(w)$ -best p -worlds are the p -worlds that are as similar to w as they can be. This semantics is a reformulation of Lewis’ (1973b) semantics for the counterfactual operator $\Box \rightarrow$ in Kratzer’s terms.⁷ The definition neglects the qualification for vacuous truth and assumes Stalnaker’s limit assumption. For the time being we assume that *want* does not play any role at all. This assumption will be revised. The truth condition for the anankastic conditional (1) reads as follows then:

- (24) “To go to Harlem you have to take the A train” is true in w with respect to g iff

⁷ For a comparison between Kratzer’s and Lewis’ semantics for counterfactuals, see (Lewis, 1981).

you take the A-train in every g(w)-best world where you go to Harlem.

The reader may wonder at this stage where the “you want” part of the antecedent figures in the truth condition. We will return to that question in section 4.3.

Note that the problem discussed in (Huitink, 2004) does not arise under this account. Recall the scenario in (19). If there are two trains going to Harlem, whatever your preferences are, the sentence is false in this situation. We are considering the next Harlem worlds. Not in all such worlds you take the A train, in some of them you take the B train. Consider now the following sentence:

(25) If you want to go to Harlem and kiss Ruud van Nistelroy, you have to take the B train.

In the given scenario, (25) is predicted true, which is correct. Interestingly, this shows that antecedent strengthening is not a valid inference for anankastic conditionals, a well-known fact about counterfactuals.

This analysis strikes us as attractive. We don't need to invent a new semantics for necessary condition sentences – we treat them as instances of counterfactuals.

4.3. *Anankastic conditionals as conditional speech acts?*

In this section we will give arguments for the claim that the *if*-clause in anankastic conditionals figures as the antecedent of what has been called a conditional speech act in the literature. Two kinds such conditionals have been studied in the literature: RELEVANCE conditionals and FACTUAL conditional.⁸ Unfortunately, ACs are different from either of them. The function of the *if*-clause is similar to that of a relevance conditional, the syntax is more like that of a factual conditional. The following examples illustrate the relevance conditional:

- (26) a. If I may be honest, you are not looking good. (Bhatt and Pancheva, 2004: [95])
 = To be honest, you are not looking good.
 b. If you want to know, 4 isn't a prime number.
 c. If you are thirsty, there is beer in the fridge.

Bhatt & Pancheva characterize this use of conditionals as follows: “The *if*-clause in Relevance conditionals specifies the circumstances in which the consequent is discourse-relevant, not the circumstances in which it is true“.

The following example is a factual conditional:

- (27) a. My friend Joe, whom you haven't met, is very smart.(Bhatt and Pancheva, 2004: [97])
 b. Oh yeah? If he's so smart why isn't he rich?

This use can be paraphrased as: „If it is true that he is so smart, why isn't he rich?“ The question is only activated in contexts where it is taken for granted that the antecedent is true. Note incidentally that the following contrast that has been observed by Ernest Adam and is quoted in(Lewis, 1973b: p. 3):

- (28) a. If Oswald did not kill Kennedy, then someone else did.
 b. If Oswald had not killed Kennedy, then someone else would have.

Lewis comments on these that the first one is presumably true while the second is false. He

⁸ The terms „factual conditional“and „relevance conditional“ are taken from (Bhatt and Pancheva, 2004: section 5.2). Presumably the terms go back at least to (Iatridou, 1991).

observes that the two cannot be distinguished simply in terms of presuppositions. He says that his theory of conditionals doesn't cover the first one. We think that it is a factual conditional, i.e., the sentence means that someone different from Oswald killed Kennedy and it is appropriate only in a context where someone different from the speaker believes that Oswald did not kill Kennedy. This factual conditional is roughly equivalent to a material conditional.

Anankastic conditionals probably aren't relevance conditionals, because they do not satisfy any of the standard tests known from the literature.⁹ The construction is not easily classified as a factual conditional either, because a factual conditional implicates that the speaker is not convinced of the truth of the *if*-clause.

We leave the precise status of the construction open but assume that the construction is a hypothetical speech act. For our purposes the following crude rule of use is sufficient.

(29) The appropriateness condition

Let c be a context of use. Then $\llbracket \text{if } \alpha \beta \rrbracket$ is only defined if $c \subseteq \llbracket \alpha \rrbracket$.

If defined, $\llbracket \text{if } \alpha \beta \rrbracket = \llbracket \beta \rrbracket$.

This trivial semantics makes it possible to account for the role of "you want" in the construction. Consider example (2). α is the clause "if you want to go to Harlem". So the entire sentence can be used only in contexts, where you want to go to Harlem. It follows that the "inner antecedent" expresses a goal of the subject of want. This explains the oddness of the following sentence:

(30) #If you don't want to go to Harlem, you have to take the A train to go to Harlem.

The antecedent tells us that the context of use implies the proposition that the addressee

⁹ Among other things, (Bhatt and Pancheva, 2004) mention the following criteria of relevance conditionals, which are mostly not met by anankastic conditionals. (i) "then" should not be possible in the consequent; (ii) in V2-languages such as German, the *if*-clause should be generated outside CP; (iii) relevance conditional can be embedded only under speech act verbs, not under "normal" attitudes.

- (A) a. #If I may be honest, then you are not looking good.
b. If you want to go to Harlem, then you have to take the A train.

In anankastic conditionals, "Then insertion" seem marginally possible:

- (B) a. Wenn es dich interessiert, 4 ist keine Primzahl.
if it you interests, 4 is no prime
b. *Wenn es dich interessiert, ist 4 keine Primzahl.
- (C) a. *Wenn du nach Harlem fahren willst, du musst den Zug nehmen.
b. Wenn du nach Harlem fahren willst, musst du den A-Zug nehmen.

The contrast between (B) and (C) shows that the *if*-clause of the anankastic construction occupies SpecCP.

- (D) a. John said that if you are thirsty there is beer in the fridge.
b. *John believes that if you are thirsty there is beer in the fridge.
c. John believes that you have to take the A train if you want to go to Harlem.

In (c) the embedded clause has an anankastic reading. So none of the standard test for relevance conditionals applies. Therefore, the anankastic *if*-construction isn't a relevance conditional of the usual kind.

doesn't want to go to Harlem. I would be impolite or pointless to utter the consequent, which contradicts the intention of the addressee. The sentence would be ok under a different construal, namely:

(31) If you don't want to go to Harlem, you have to take the A train for not going there.

Though appropriate, such a statement would be a lie under the actual circumstances.

4.4. *Ellipsis resolution: the implicit restriction of the anankastic modal*

As von Fintel and Iatridou have observed, anankastic *want*-conditionals are elliptical. An explicit statement of the Harlem example was given above and is repeated here:

(32) If you want to go to Harlem, you have to take the A train *to do that*.

= If you want to go to Harlem, you have to take the A train to go to Harlem.

The truth condition we have given in section 4.2 was intended for the main clause, which doesn't contain "want". One function of the if-clause is that it delivers the antecedent for the ellipsis. So a closer inspection reveals that the Harlem-sentence doesn't express a conditional with one antecedent, but a conditional with two antecedents, one of which is the if-clause of the conditional speech act and the other is the restriction of the modal. The LF of the sentence is something like this:

(33) If you want to go to Harlem [you have [to go to Harlem] to take the A train]

We claim that it is the *to*-clause that functions as the restriction of "have to", not the if-clause. The complex main clause alone expresses the following anankastic conditional, and that is all what we need:

(34) In all the worlds where the goal that you go to Harlem is achieved and which make as many of the facts true as possible, you take the A train.

It seems to us that this is precisely what von Fintel & Iatridou and Huitink have in mind. But we have said more than them, namely what the relevant facts in the modal base are, namely those that are "cotenable with the antecedent".¹⁰

Turning back to anankastic conditionals, we suggest that the function of the *if*-clause is to reaffirm that the context is appropriate for the following elliptical anankastic statement. For these particular conditionals, it has to follow from the context that the antecedent is somebody's goal or wish for the anankastic statement to be felicitous.

The teleological aspect is inherent to all kinds of anankastic sentences and was responsible for assuming the corresponding kind of ordering source in the previous analyses. We believe that this meaning component is due to the presupposition associated with every

¹⁰ For the notion of cotenability, see (Lewis, 1973b: 2.6). χ is cotenable with premise ϕ in world w if either (1) $\chi = W$ or (2) χ holds throughout some ϕ -permitting sphere around w . A counterfactual $\phi \square \rightarrow \psi$ is true in world i iff there is an auxiliary premise χ cotenable with ϕ in world i such that ϕ and χ together logically imply ψ . χ may be regarded as the circumstantial modal that is needed for the modal analysis of Huitink to work. Each counterfactual can be reformulated as a strict conditional along these lines, but we have a price to pay: the cotenable premise depends on the antecedent of the conditional. Different conditionals require a different cotenable premise. In the same way the circumstantial modal base cannot be provided by the context: it depends on the antecedent. Intuitively, it is unclear what the cotenable premise should be. There is no way of making the premise explicit by means of one or more paraphrases.

anankastic conditional, namely, that the restriction of the anankastic modal is in the set of goals attributed to the logical subject of the matrix clause or the *if*-clause in the evaluation world. This leads to a more accurate formulation of the meaning of the anankastic *must/have to*:

- (35) Entry for the anankastic *have to*¹¹
 $[[\text{have to}_{ac}]]^{f,g,c}(w)$ is only defined if c is a Stalnaker common ground, $f(w) = W$ and $g(w)$ is totally realistic. When defined,
 $[[\text{have to}_{ac}]]^{f,g,c}(w) = \lambda p_{st.c} \subseteq \text{goal}(p): \lambda q_{st}. (\forall w' \in f(w))(p(w') \ \& \ (\neg \exists w''(w'' <_{g(w)} w' \ \& \ w'' \in p) \rightarrow w' \in q)$

Given that $f(w) = W$, the truth condition boils down to $\lambda p_{st.c} \subseteq \text{goal}(p): \lambda q_{st}. (\forall w' \in p) (\neg \exists w''(w'' <_{g(w)} w' \ \& \ w'' \in p) \rightarrow w' \in q)$, i.e., q is true in the nearest p -worlds.

The restriction on the first argument makes it to one of the salient goals in the evaluation world. ($\text{goal}(p)$ is the proposition that p is goal, i.e. p is wanted.) This condition has to be met for the utterance to be appropriate in the context.

By ascribing the “goal” status to the antecedent of anankastic conditionals we explain why anankastic conditionals are talking about goals and means for achieving them. This is what makes anankastic conditionals distinct from other kinds of conditional statements, in particular subjunctive conditionals. Note that so far the distinction does not concern the truth conditions but is on the pragmatic level.

4.5. Comparing anankastic conditionals and would-conditionals

Hearing the term “counterfactual analysis”, one thinks immediately of *would/could*-conditionals, and one would think that every anankastic conditional is expressible as a *would*-conditional. This, however, is not so, and this fact has been objected to our proposal. Recall, however, that the Stalnaker/Lewis semantics for counterfactuals has nothing to do with wording. The counterfactual semantics covers both subjunctive and indicative conditionals, though these seem to have quite different meanings. The difference in meaning is explained by a difference in felicity conditions for use: the antecedent of an indicative conditional must be compatible with the common ground.¹² Counterfactual “carry some sort of presupposition that the antecedent is false” (Lewis, 1973b: p. 3), i.e., the antecedent of a subjunctive conditional must be incompatible with the common ground. The anankastic conditionals considered so far are indicative conditionals and are therefore used in different context from *would*-counterfactuals. A further difference is that the restriction of “have to” is an infinitival. Infinitivals under modals are future oriented if they express a non-stative Aktionsart, and *to*-infinitivals are seem to be future oriented quite generally. n approximate paraphrase of our anankastic conditional as a “normal” conditional should be something like this:

- (36) You have to take the A train to go to Harlem

¹¹ Henceforth we use the convention for formulating presuppositions adopted in (Heim and Kratzer, 1998). Our definition must be read as follows:

$[[\text{have to}]]^{f,g,c}(p)(q)$ is defined iff $c \subseteq \text{goal}(p)$. If defined, $[[\text{have to}]]^{f,g,c}(p)(q) = 1$, iff $(\forall w' \in p) \neg \exists w''(w'' <_{g(w)} w' \ \& \ w'' \in p) \rightarrow w' \in q$

¹² Here is the relevant quote from (Stalnaker, 1975) making the point clear: “It is appropriate to use an indicative statement or supposition only in a context which is compatible with the antecedent.”¹² Subjunctive conditionals, on the other hand, are argued to presuppose that their antecedent is false.

=? If you will go to Harlem, you must take the next A train.

The translation is not perfect, because the information that the antecedent is a goal of the subject is not expressed. If we take account of future orientation and add the information that the antecedent is a goal there is some plausibility that the former to sentences have the same truth conditions.

Other cases, however, seem to speak against this identification. Consider the following classical example from (Lewis, 1973b):

- (37) a. If Otto behaved himself, he would be ignored. (Lewis)
b. For Otto to behave himself, he has to be ignored.

These strike us as different in meaning. Let us look what our account can say about the contrast. The first difference comes from the difference in temporal orientation. The first sentence speaks about counterfactual behaviour now and a subsequent ignoring. In the second sentence, the ignoring comes first and the well behaving later. So the two cannot mean the same. But even if so, there is another difference: the second sentence gives the information that a possible future well behaving of Otto has to be caused by the ignoring. There is no such relation of causation in the first sentence. The meaning rule given in (35) doesn't express this causation. It is perhaps too weak as it stands.

The impression that there is a real difference in truth conditions between would-conditionals and anankastic ones grows stronger when we look at Lewis' standard example:

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

Here both the antecedent and the consequent are states, and stressing our intuitions somewhat, the second sentence may have a simultaneous interpretation, even a tenseless one. Again we have the feeling that the two mean something different. The second sentence suggests that the habit of toppling over somehow causes the state of having no tails. This is an absurd idea. Therefore our reaction is that we don't understand (b) or that it is false. (a) on the other hand is true. Again our meaning rule (35) cannot explain the difference. The following list contains examples with decreasing anankasticity:

- (39) a. In order to go to Harlem, you have to take the A train.
b. In order to go to Harlem, you have to take a train.
c. In order to go to Harlem, you have to wait.
d. In order to go to Harlem, you have to breath.
e. In order to go to Harlem, you have to be a person.

The intuition seems to be that the consequent can be regarded less and less as a means for achieving the truth of the antecedent. It would seem then that anankastic necessity is a stronger logical relation than counterfactual necessity. So it was perhaps premature to identify the two relations. Let us introduce a notation that distinguishes them.

To facilitate the reading, let us use Lewis' notation for counterfactuals instead of Kratzer's:

- (40) $\phi \Box \rightarrow \psi$ is true in world w with respect to the ordering relation \leq iff ψ holds in every \leq -next ϕ -world.
 $\phi \Diamond \rightarrow \psi$ is true in world w with respect to the ordering relation \leq iff ψ holds in some \leq -next ϕ -world.

Recall that the ordering relation \leq can be defined via an ordering source g . Let us denote the anankastic relation by means of the symbol $\bigcirc \rightarrow$. In the previous section we assumed the identity of $\Box \rightarrow$ and $\bigcirc \rightarrow$. The considerations of this section suggest that $\bigcirc \rightarrow$ is a stronger

relation. Or is it perhaps a logically independent relation? We don't think so because in certain respects $\circ \rightarrow$ behaves like $\square \rightarrow$: neither of the two relations allows for strengthening of the antecedent, for transitivity or for contraposition.

- (41) No strengthening of the antecedent
 $\phi \circ \rightarrow \psi \neq \Rightarrow \phi \& \chi \circ \rightarrow \psi$

An example of case was Huitink's (25), which shows that the following argument is invalid.

- (42) If you want to go to Harlem, you have to take the A train.
 \therefore If you want to go to Harlem and see Ruud van Nistelroy, you have to take the A train.

As for counterfactual, transitivity does not hold for $\circ \rightarrow$. We can show that by using Lewis' examples.

- (43) Failure of transitivity
 $\phi \circ \rightarrow \psi \& \psi \circ \rightarrow \chi \neq \Rightarrow \phi \circ \rightarrow \chi$
 For Otto to go to the party, Anna has to go.
For Anna to go to the party, Waldo has to go.
 \therefore For Otto to go to the party, Waldo has to go.

The argument is invalid similar reasons as those given in (Lewis, 1973b: p. 33). Contraposition cannot hold either as an adaptation of an example of Lewis shows:

- (44) Failure of contraposition
 $\phi \circ \rightarrow \psi \neq \Rightarrow \neg \psi \circ \rightarrow \neg \phi$
For Boris to go to the party, Olga has to go.
 \therefore For Olga not to go to the party, Boris has not to go.

Let us summarize the discussion in this section. With respect to strengthening of the antecedent, transitivity and contraposition, the anankastic relation $\circ \rightarrow$ and the counterfactual relation $\square \rightarrow$ behave alike. An identification of the two relations could explain the behaviour. On the other hand, a plain modal account would have to say something to the question of why these logical properties don't hold.

We observe, however, that *would*-conditionals cannot be paraphrased as ACs and we have to explain why this should be so.

Differences in meaning might come from the different felicity conditions for the use of the two constructions and the difference in temporal orientation.

So far we have been assuming that ACs are indicative conditionals and therefore subject to Stalnaker's restriction. But it is not clear that indicativity is an essential restriction for ACs can be put into the subjunctive:

- (45) To go to Harlem, you would have to take the A train.

The requirement that the antecedent has to be goal doesn't help to distinguish the two constructions either. It might be a goal that kangaroos have no tails, but still sentence (38b) is very odd. Our semantics doesn't express the idea that the proposition that kangaroos topple over describes the most appropriate means for making sure that they have no tails.

The only important difference that might yield an explanation is the difference in temporal orientation. If the antecedent and the consequent of a *would*-conditional are both in the present tense, the antecedent will typically be true before the consequent. For an AC, the typical temporal relation is exactly the other way round. The antecedent will be true after the consequent. This fact suffices to guarantee a difference in meaning in many cases.

This, however, cannot explain all weird examples. The kangaroo-example cannot be

blocked because the sentence expresses a sort of law and is therefore timeless. The same can be said for other laws:

(46) If this water is to boil, its temperature must be 100⁰ Celsius.

This is an AC. Thus it seems that the definition of the anankastic relation should be something like this:

(47) $\phi \circ \rightarrow \psi : \Leftrightarrow \phi \square \rightarrow \psi \ \& \ \psi R \phi$, where R means “is a means for achieving”

The question is of course, what R could be. This is the topic of the next section.

4.6. *Strengthening the meaning of the anankastic modal?*

The most obvious way of expressing the idea that the consequent somehow causes the truth of the antecedent is to build in contraposition in the semantics, because this is the essential ingredient of defining causation.¹³

(48) $\phi \circ \rightarrow \psi : \Leftrightarrow \phi \square \rightarrow \psi \ \& \ \neg \psi \square \rightarrow \neg \phi$?

In other words, $\psi R \phi$ would be the contraposition of $\phi \square \rightarrow \psi$. We know, however, that contraposition doesn't hold of $\circ \rightarrow$. So this definition is not an option. In addition, the definition would not block any of the problematic examples of the last section. For instance, the anankastic conditional (38b) would still be true.

Another failing attempt consists in adding the intuitively correct condition underlying the following version of an AC:

(49) You can't go to Harlem without taking the A train.

In other words let $\phi R \psi$ be the statement $\neg(\phi \diamond \rightarrow \neg \psi)$.

(50) $\phi \circ \rightarrow \psi : \Leftrightarrow \phi \square \rightarrow \psi \ \& \ \neg(\phi \diamond \rightarrow \neg \psi)$?

This doesn't buy anything because the second conjunct means precisely the same as the first one.

In a previous version of this paper we tried to use a different semantics for making (38b) false.

(51) $\phi \circ \rightarrow \psi$ ist rue in $w : \Leftrightarrow \text{Sim}_w(\phi) \subseteq \text{Sim}_w(\psi)$?

Here, $\text{Sim}_w(\phi)$ are the ϕ -worlds that are most similar to w . This semantics would make (38b) false and could therefore explain its oddness. (Huitink, 2004) has objected that this proposal would make anankastic statements with a false antecedent and a true consequent false. (In addition, the anankastic relation would be transitive.) Huitink gives the following example:

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

She assumes a scenario where no combustion occurs but where oxygen is present. The sentence is law of nature and should not depend on the actual truth of the antecedent or consequent. So this is another failed attempt.

We have no better idea of how to define the relation R. So either you take the relation “is a means for achieving” as a primitive, or you stick to the meaning rule in (35).

¹³ See (Lewis, 1973a).

4.7. “Want” vs. “be to”

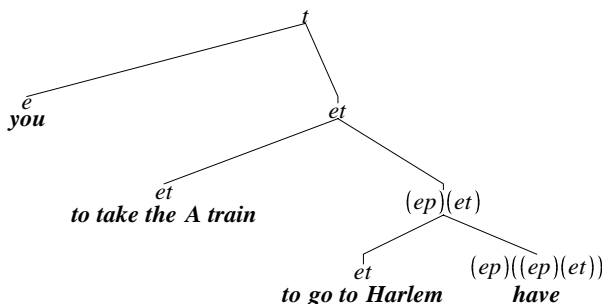
As a final step in our analysis we will explicate another, purely syntactic, function of *if*-clauses. This section will offer a way to account for the distribution of *want/be to* in the *if*-clauses observed by Sæbø. The truth condition for anankastic conditionals stated in (24) treats the *to*-antecedent of the main clause as if it were a proposition. But the actual syntax is not exactly like that. After resolution of the ellipsis, the antecedent of the conditional is a *to*-clause. The missing subject is redetermined by lexical control of the modal “have to”. The complement of “want” is a constituent that has precisely the correct logical type for serving as an argument of a control modal “have”.

- (53) Entry for the anankastic control *have to*¹⁴:
 $[[\text{have to}_C]] = \lambda P \in D_{s(et)}. \lambda q \in D_{s(et)}. \lambda x \in D_e. \lambda w'. P_{w'}(x) \text{ is a goal of } x \text{ in } w.$
 $\lambda w'. P_{w'}(x) \text{ is true in } g(w)\text{-nearest } \lambda w'. P_{w'}(x)\text{-worlds.}$

The index C stands for control here. This **have_C** requires a *to*-infinitive as the first argument. P and Q are properties of individuals, i.e., they have the type *s(et)*. We have ignored the modal base, because it plays no role for the evaluation of the counterfactual. *g(w)* is a totally realistic ordering source. Let us apply this semantics to the Harlem sentence. After ellipsis resolution, it is (54) and its LF is (55).

- (54) If you want to go to Harlem you have to take the A train.

(55)



The type mismatch requires the application of Intensional Functional Application two times.¹⁵ The analysis predicts that we have subject identity in anankastic conditionals that are introduced by an *if*-clause containing “want”. This prediction seems to be born out by the facts. The precise formulation of the truth condition for (54) is given in (24).

Now let us look at the structure with *be to*:

- (56) If David is to recover we must/have to find him a maid.

Again, we have to make the elliptic main clause explicit. A possible ellipsis resolution might be this.

- (57) For David to recover, we must/have to find him a maid.

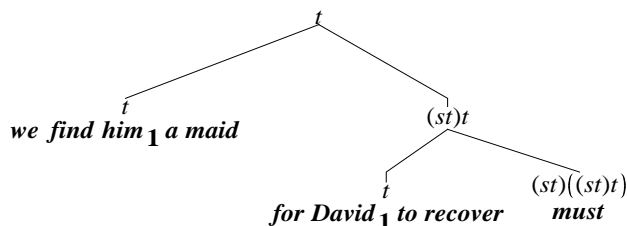
This time, the anankastic modal must be a raising verb. The LF for the construction would

¹⁴ Here and in the rest of the definitions we ignore the assignment function.

¹⁵ See (Heim and Kratzer, 1993: chapter 12)

look like the following:

(58) LF for (57)



The meaning rule for impersonal anankastic “must” is given in (35), The *if*-clause provides the correct constituent for the antecedent of the conditional expressed by the main clause, viz. something of the sentence type. Note that we have to assume that ellipsis resolution takes place before we raise the subject in the *if*-clause over the modal “is to”. Using appropriate Intensional Functional Application, we calculate the correct truth condition for the LF:

(59) “If David is to recover we have to find him a maid ” is true in w with respect to g iff $\text{Sim}_w(\lambda w. \text{David recovers in } w) \subseteq \lambda w. \text{we find David a maid in } w$.

4.8. Other types of anankastic sentences

In our analysis, the contribution of the *if*-clause to the semantics is to determine the ellipsis resolution in the matrix clause. This brings up the question whether *if*-clauses are unique in this respect or whether there are other types of clauses that can provide the antecedent for an anankastic sentence. It turns out that the relative clauses containing “want”/“be to” can also have this function. Consider the following German examples:

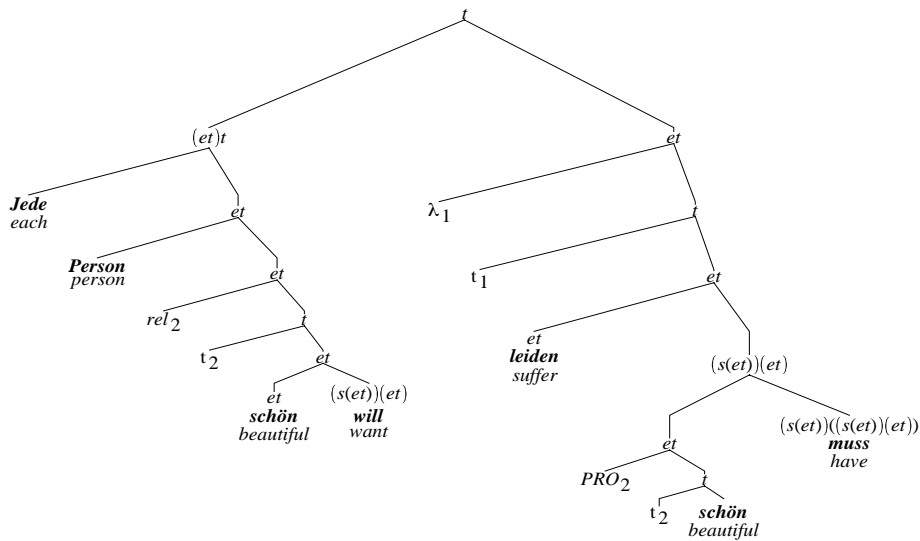
- (60) a. Wer schön sein will, muss leiden.
 ‘Whoever wants to be beautiful has to suffer’
- b. Die Bücher, die du ausleihen willst, musst du dem Bibliothekar geben.
 ‘You have to give the books you want to borrow to the librarian’

These sentences are clearly anankastic. Our analysis for anankastic conditionals immediately extends to them. We suggest that they contain elided *to*-clauses, and after ellipsis resolution correspond to:

- (61) a. Wer schön sein will, muss leiden, um schön zu sein.
 ‘Whoever wants to be beautiful has to suffer to be beautiful’
- Die Bücher, die du ausleihen willst, musst du dem Bibliothekar geben, um sie auszuleihen.
 ‘You have to give the books you want to borrow to the librarian to borrow them’

As approximation to the meaning of the free relative “wer” (“whoever”), we assume that it is equivalent to a universal quantifier plus a relative pronoun, i.e. “everybody who”. After reconstruction of head movement, topicalisation, deletion of the semantically inert material, and QR of the subject, this leads to the following LF for (61a):

(62)



This LF expresses the following truth condition:

- (63) „Wer schön sein will, muss leiden“ is true in w with respect to g iff
 $\forall x[\text{person}(x) \ \& \ x \text{ wants to be beautiful}] \rightarrow$
 $\text{Sim}_w(\lambda w.x \text{ is beautiful in } w) \subseteq \lambda w.x \text{ suffers in } w$

As can be seen in (63), the relative clause including “want” contributes to the truth conditions of the sentence by restricting the domain of the universal quantifier to people who want to be beautiful. So in contrast to *if*-clauses, which participate in the ellipsis resolution and have a pragmatic function, relative clauses enter into the truth-conditions.

As one might expect, free relatives containing “want”/”be to” are used synonymously to anankastic conditionals, as the following English translation (64a) of a sentence by Nietzsche given in (64b) shows:

- (64) a. Whatever is to be beautiful must also be sensible.
 b. Alles muss bewusst sein, um schön zu sein.
 ‘Everything must be sensible to be beautiful’

These examples from the Web, which have been brought to our attention by Ventsislav Zhechev, are very interesting for the following reason. The original German sentence contains an overt purpose clause (“um schön zu sein”) in the main predicate but no overt relative clause that restricts the universal quantifier in subject position. The English translation has it the other way round: we find an overt relative clause that restricts the quantifier (“that is to be beautiful”) but no overt purpose clause in the main predicate. We take this as evidence that anankastic constructions are typically elliptical. The information “be beautiful” is present at two places at LF in (62) but pronounced only once.

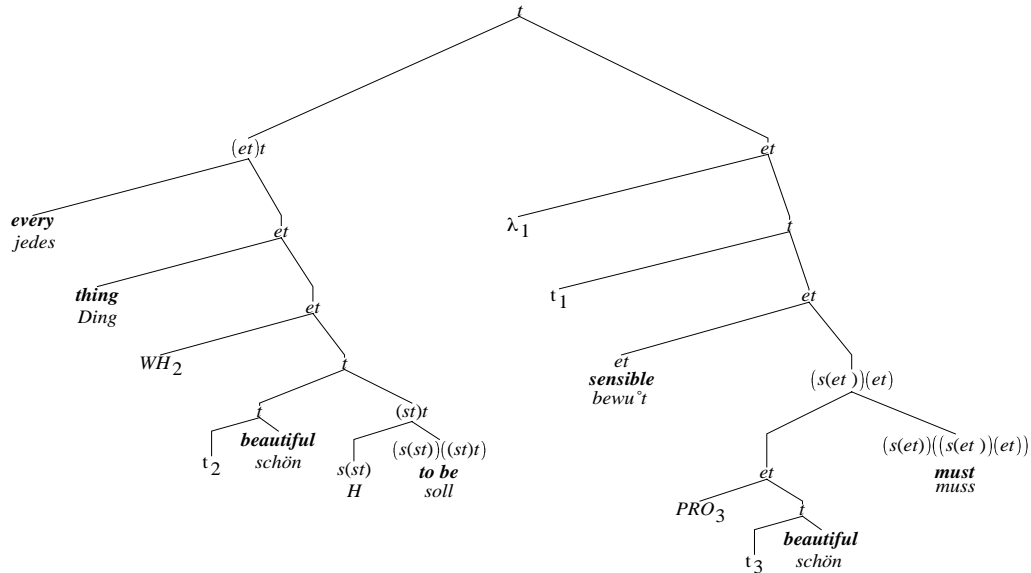
The following comparison makes the complementary strategy in resolving the ellipsis evident:

- (65) Alles, was schön sein soll, muss bewusst sein, um schön zu sein.
 Everything, that is to be beautiful, must be sensible to be beautiful.

The modal in the main predicate is the controlling anankastic “must”/”muss”. The part of the main clause that is copied into the relative clause restricting the quantifier, viz. “x

beautiful”, contains a variable that is bound by the QR-ed subject. After copying, it is bound by a relative operator. This is a case of “vehicle change” in the sense of (Fiengo and May, 1991). The resulting LFs are basically the same for English and German.

(66)



The truth condition of the LF can be paraphrased in this way: Everything that is beautiful in every world that fulfils our standards for beauty is sensible in the nearest worlds where it is beautiful. The observed equivalence of (64a) and (64b) is thus explained.

Note that we don’t claim that we have offered a general procedure that can handle with ellipsis resolution of anankastic conditional. What these examples are supposed to show is that anankastic conditionals with a *want*-antecedent are elliptic in the general case.

4.9. "Contraposition"

Following G. Bech, Sæbø also considered a “contraposed” paraphrase to which we turn now:

(67) If you don’t take the A train, you can’t go to Harlem.

According to Bech and Sæbø this sentence means precisely the same as (1a). We are not convinced that this correct. The intuitively correct paraphrase of the truth condition is this:

(68) There is no nearest world where you don’t take the A train but where you nevertheless go to Harlem.
 = The nearest non-A-train worlds are disjoint from the Harlem worlds

In Lewis’ terms, the truth condition should be this:

(69) $\text{Sim}_w(\lambda w.\text{you don't take}_w \text{ the A train}) \cap \lambda w.\text{you go}_w \text{ to Harlem} = \emptyset$

$$= \neg(\neg\psi \diamond \rightarrow \phi)$$

This is only a consequence of the anankastic must-conditional, and we are content with that. In fact, the truth condition is very weak. It is satisfied by two disjoint propositions ϕ and ψ that are false in the actual world. We would obtain a statement that is equivalent to the AC if the LF were $\neg(\phi \diamond \rightarrow \neg\psi)$. Recall the discussion concerning (50). But it we cannot see how this could be derived from the syntax.

Note finally that the sentence in (67) is not a contraposition of (1a) in logical terms. The consequent of the original sentence is negated and forms the antecedent of a new conditional. But the latter isn't a would-conditional, but a could-conditional. Furthermore, the consequent of this conditional is not negated, but the entire conditional is negated. It is therefore kind of a misnomer to call this construction "contraposition".

4.10. Restricting the Modal Base?

Expressing necessary condition is a context-sensitive matter in another respect. One should speak about necessary condition relativized to certain facts. The following sentence (by Wolfgang Klein, p.c.) illustrates this idea:

(70) If you want to go to Vladivostok you have to take the Chinese train.

Now assume the following scenario: there are two trains, the Russian train and the Chinese train. The Chinese one offers a much better service. For W. Klein, the conditional is true in this situation. But is it an anankastic conditional? For Orin Percus, the conditional is wrong in the scenario given. He would have to use the modal "should" for obtaining a true statement:

(71) If you want to go to Vladivostok you should take the Chinese train.

This is not an anankastic conditional meaning "The only way to go to Vladivostok is to take the Chinese train".

On the other hand, we obtain true anankastic conditionals if we make the condition „to have good service“ explicit in the antecedent:

(72) a. If you want to go to Vladivostok comfortably you have to take the Chinese train.
b. To go to Vladivostok comfortably you have to take the Chinese train.

It is an empirical question whether (70) means the same as these in the scenario given. If anankastic conditionals were context dependent in this sense, one would have to restrict the modal base by adding additional facts. In our example $f(w)$ would contain information about your preferences, viz. that you travel by trains with the best service¹⁶. In any case, *should*-conditionals are interpreted with respect to such a personal modal base.

In general, the restriction of the modal base seems to be needed quite often, and not only for *should*-conditionals. One can come up with scenarios where *to*-infinitive constructions or *can*-conditionals have to be weakened in a similar way.

Consider the following example in which the restriction is introduced explicitly:

(73) To go to Harlem you have to take the A train, unless you have enough money for a

¹⁶ We no longer refer to $f(w)$ as a realistic conversational background in a narrow sense. Within a general theory for conditionals, $f(w)$ is to be thought of a set of propositions that do not have to be consistent.

taxi.

The hypothetical fact introduced by the *unless*-clause „you don't have enough money for a taxi“ restricts the modal base. It is not empty anymore but contains an additional antecedent. The sentence is true iff in all the next worlds, in which you go to Harlem and don't have enough money for a taxi, you take the A train.

5. CONCLUSION

The counterfactual analysis of anankastic conditionals solves the puzzles we have encountered so far in connection with these constructions. Compared to competing modal analysis it has the advantage of being precise about the modal base: it contains the nearest antecedent worlds.

After ellipsis resolution, the analysis is entirely compositional. The role played by “want” or “to be” is to introduce a felicity condition on the use of the conditional. These modals do not contribute to the truth condition of the anankastic conditional.

The account over-generates. It classifies conditionals as anankastic that are intuitively weird. Our conjecture was that this has to do with the circumstance that we don't understand the relation “being a means for”. More generally, we should have a better understanding of the semantics of purpose clauses about which we know nothing. We think similar difficulties arise with the competing modals approaches as well. They are simply not addressed there.

6. APPENDIX: A NOTE ON OUR SEMANTICS

We are using the logical types e (individuals), s (worlds) and t (truth values) with their usual interpretation. The lexical meanings of extensional types are intensions. For instance, the lexical meaning of „sleeps“ is the following:

$$(74) \quad \llbracket \text{sleeps}_{\text{et}} \rrbracket = \lambda w. \lambda x. x \text{ sleeps in } w$$

Sentences have the type t , but modal operators require arguments of type st . In that case we have to use the rule of Intensional Functional Application to remedy the type mismatch.

(75) Intensional Functional application.

Suppose we are given a functor ϕ of type $(sa)b$ and an argument α of type a . Then the tree $[\phi \alpha]$ has the meaning $\lambda w. \llbracket \phi \rrbracket(w)(\lambda w'. \llbracket \alpha \rrbracket(w')) = \lambda w. \llbracket \phi \rrbracket(w)(\llbracket \alpha \rrbracket)$.

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