ON THE TEMPORAL ORGANISATION OF INDICATIVE CONDITIONALS

ATLE GRØNN & ARNIM VON STECHOW

1. PLOT

We have already written a number of papers and hand-outs about the temporal organisation of subjunctive conditionals and we are currently putting that work together. But we haven't said anything of indicative conditionals. The present account is motivated by a sweeping attack by Katrin Schulz against our account of subjunctive conditionals and that of Angelika Kratzer; see (Schulz, 2009a, Schulz, 2009b). K. Schulz extends the criticism to Kratzer's analysis of indicative conditionals. She gives examples involving tense that are said to provide insurmountable difficulties for theories of our style.

Here we will give our account of indicative conditionals. The theory will be a tensed version of Kratzer's theory of indicative conditionals and much care will be devoted to justifying the morphology observed in these constructions. We will meet the possible objections by Schulz, but we admit that ultimately, a dynamic semantics will cope better with the facts than the static framework assumed here. Thus we sympathize with one of the points made be Schulz. On the other hand, we don't think that any parts of Schulz' criticism can hit the essentials of Kratzer's analysis. We have to add that the details of the temporal analysis of indicative conditionals presented below are novel to our knowledge.

In Kratzer's and our account, an indicative conditional will have the following form[1]:

(1) Indicative Conditional

Tense $MUST_R$ (if A) (C)

The modal MUST is covert. For the time being we assume that $MUST_R$ is a 2-place verbal quantifier that takes the antecedent A as the restriction and the consequent as its nuclear scope. We will see in a moment that modals should better be regarded as 1-place operators and we will revise this initial assumption accordingly. MUST is a universal quantifier and has a restriction R given by the context, an accessibility relation (called conversational background be Kratzer). This restriction can be further restricted by the *if*-clause *A* ("antecedent" of the conditional). There is an important syntactic difference between constructions with a covert modal and those that have an overt one:

(2) If John passed the exam, he must be happy.

(3) If John passed the exam, MUST he is happy.

The open modal in (1) is a finite verb and has a non-finite verb ("be") in its nuclear scope ("the prejacent"). The covert MUST has no morphology and has a finite verb ("is") in its nuclear scope. The restriction, i.e. the *if*-clause, is finite in both cases.

For the temporal organisation of conditionals, it is important to look at the semantics of the modal: it controls the local evaluation time both of the antecedent and the consequent:

(4) $must_R$ /$MUST_R$, type i(s(it)),((s(it)),t) (to be revised)

$[\![must_R / MUST_R]\!]^g = \lambda w \lambda t \lambda p \lambda q.(\forall w')[w\ g(R)_t\ w' \ \&\ p(w')(t) \rightarrow q(w')(t)]$

An immediate impact of this rule is that the temporal centre ("the point of perspective") in both antecedent and consequent is bound by the modal. So it appears that we cannot have deictic tenses in these sentences, but we obvious have those. For instance, both the semantic past and the semantic present in (3) are deictic.

The problem, however, is only apparent. The semantic present will always denote the

[1] The analysis which assumes a covert MUST for indicative conditionals goes back to Kratzer, A. 1978. *Semantik der Rede. Kontexttheorie - Modalwörter - Konditionalsätze*. Kronberg/Ts.: Scriptor, Kratzer, A. 1979. Conditional Necessity and Possibility. In *Semantics from Different Points of View*, eds. A. von Stechow and et al., 117-147. Berlin: Springer, Kratzer, Angelika. 1977. What 'must' and 'can' must and can mean. *Linguistics and Philosophy* 1:337-355.

speech time, but the semantic past is interpreted as a relative tense that gives us a time before the local evaluation time. If the local evaluation time is the speech time, we have a deictic past. We have taken the decomposition of the semantic past into PRES + PAST from (Heim, 1997).

(5) Tense

a. Present: N type i

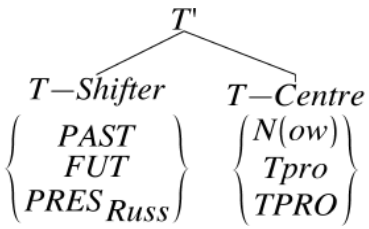
$[\![N]\!] = \lambda w.s^*$

b. Past: PAST type i(it,t)

$[\![PAST]\!] = \lambda w \lambda t \lambda P_{it} (\exists t' < t)\ P(t)$

The Present N and the Past PAST have a different status conceptually. N is deictic pronoun denoting the speech time, PAST is a time shifter. Generally we assume that tense phrases of natural languages have the following structure:

(6) The TP



TPRO is semantically empty; it is the T-centre of complements of attitudes and in if-clauses. Tpro is an anaphoric temporal pronoun; it is the T-centre of relative clauses. PRES is the trivial time shifter (identity) used in non-SOT-languages like Japanese or Russian. For a more detailed motivation of this theory, see (Grønn and von Stechow, 2010a) or (Grønn and von Stechow, 2010b).

The LF of the conditional in (3) is now something like this:

(7) If John passed the exam, he is happy.

N λt MUST(t) (**if** λt PAST(t) λt **John passed**(t))(λt **he is**(t) **happy**)

$= \lambda w.(\forall w')[(wR_{s*}w' \ \&\ (\exists t < s^*)\ \text{John passes}(w',t)) \rightarrow \text{he happy}(w',s^*)]$

The meaning shows that we have a deictic past in the antecedent and a deictic present in the consequent despite the fact that we have no deictic centre in these sentences on the surface. The deictic centre, i.e. the semantic present, comes in via λ-conversion. The sentence in (2) is analysed exactly alike. We explain the term "deictic centre" in a moment.

Here is an example from (Schulz, 2009b), which according to her should be

problematic for approaches of the kind described here:

(8) If John went out smiling, the interview went well.

Our analysis is this:

(9) N λt MUST(t) (if λt PAST(t) John went(t)...)(λt.PAST(t)λt the interv. went(t)…)

Indeed, any static framework like will face some problems with examples like these. The interview is before the hypothetical coming out. Our LF doesn't express this and there is no static LF that can express this, because we have a typical donkey configuration for tense. We would have a similar problem with indefinites in the antecedent:

(10) If someone went out smiling, then his interview went well.

his is a donkey pronoun whose antecedent is *someone*. In a dynamic framework the truth-conditions for (10) could be something like the following, provided we want the strong donkey reading:

(11) (∀w')(∀x)(∀t)[(w R_{s*} w' & t < s* & person(x,w',t) & comes-out-smiling(x,w',t))
→ **(∃t' < t)**(∃y)(interview-of(y, x, w', t') & goes-well(y, w', t')]

This time the PAST in the consequent is anaphoric to the past in the antecedent. This would certainly be a better approach, but we won't elaborate it here because it complicates matters considerably without affecting the essential point of the analysis.

2. WHAT KIND OF MODAL?

We follow (Kratzer, 1977), (Kratzer, 1978), (Kratzer, 1979) in assuming that *if*-clauses in bare conditionals always modify an invisible modal MUST. This raises the question of what kind of necessity this is. In (Kratzer, 2010) and previous papers it is argued that the invisible MUST is an epistemic modal. The covert operator may also be a generic operator or perhaps a habitual operator, but we neglect this possibility. An epistemic modal base in the sense of Kratzer is based on an accessibility relation R that assigns to each world a set of "facts". Since facts are mutually compatible propositions we may take their intersection and say that each world is assigned a proposition true in that world, i.e. for each w, w ∈ {w' : wRw'}, equivalently, R is reflexive. R must depend on time because we know different facts at different times. Here we change our initial assumption that modals have two propositions as arguments to the assumption that they have only one syntactic argument, the "prejacent". We

will see that the "antecedent" is reconstructed as an adjunct of the modal.

(12) Covert MUST, type i(s(it)), R a variable of type s(i(st))

$[\![\text{MUST}_R]\!]^g = \lambda w \lambda t \lambda p$: g(R) is reflexive.$(\forall w')[w\ g(R)_t\ w' \rightarrow p(w)(t)]$

This MUST is defined also for indicative sentences without an *if*-clause. Normally we don't want this modal for such cases. So either we say that MUST is only inserted if there is an *if*-clause without a quantifier it can restrict. Or we say that $\{w' : wRw'\} = \{w\}$ for any w in such a case. Thus, the accessibility relation is trivialised and the modalized statement is equivalent wit the non-modalized one. Note that for Kratzer it is very important that modals are one-place operators. So what about *if*-clauses? Before we come to these, let us consider subjunctive modals as we find them in counterfactual statements like the following ones:

(13) If John were sick, he would stay home.

(14) If John stayed home, he could be sick.

If we left the *if*-clause away, it would be hard to understand these sentences as "counterfactual". *would* would rather be interpreted as an habitual modal and *could* as an epistemic modal. For reasons that become clear in a moment, it is better, however, to consider also these modals as 1-place ones. Here is an interpretation in the style of (Lewis, 1973) and (Lewis, 1979). Lewis' modals are interpreted with respect to a similarity relation $\leq$ that orders the accessible worlds with respect to the local evaluation world w: $w_1 \leq_w w_2$ means that w_1 is at least as similar to w as w_2. $<$ is the derived strict order. In addition we assume that at a given time t only those worlds w' are accessible from w that have a common past with w up to time t. If we assume determinism, the accessible worlds at time t are Dowty's inertia worlds used for the interpretation of the progressive; cf. (Dowty, 1979).

(15) Lewis' Modals. type i(s(it),t)

a. $[\![\text{would}_R]\!]^{g \leq} = \lambda w \lambda t \lambda p_{sit}$: g(R) as below.$(\forall w')[(w\ g(R)_t\ w' \ \&\ \neg(\exists w'')[w\ g(R)_t\ w'' \ \&\ w'' <_w w']) \rightarrow p(w')(t)]$,
where $w\ g(R)_t\ w'$ iff w and w' have the same past up to time t.

b. $[\![\text{could}_R]\!]^{g \leq} = \lambda w \lambda t \lambda p_{sit}$: g(R) as below.$(\exists w')[(w\ g(R)_t\ w' \ \&\ (\forall w'')[w\ g(R)_t\ w'' \rightarrow w' \leq_w w'']) \ \&\ p(w')(t)]$

Without further restriction, these modals don't add anything to the content. This is so because at each time t every world that is maximally similar to the local evaluation world while having the same past is the local evaluation world itself. This trivialisation of the

modals might be the reason for why we virtually never use these modals without a restriction.

(16) John would stay home (counterfactual sense!)
= John could stay home
= John stays home

A similar analysis of *would* is given in two steps in (Ippolito, 2003). But the details of her analysis of *would*-conditionals and *would-have* conditionals are quite different from ours, and she seems to have given up that approach in later papers.

3. IF-CLAUSES

The first section started with the assumption that modals may be two place verbs/operators. But we know from (Kratzer, 2010) and (Schulz, 2009b) that this cannot be right. The reason is that a modal can be restricted by more than one *if*-clause, and one if-clause can restrict more than one modal.

Examples for the first case are easy to find:

(17) If Mary is in Oslo, John is happy, if she is with him.
= If Mary is in Oslo and she is with him, John is happy.

So *if*-clauses can be stacked like relative clauses. If *if-then* were a two-place operator, this could not be explained. The following example for the second case is from Kratzer 2010:

(18) [= Kratzer's (30)]
If a wolf entered the house, he must have eaten grandma, since she was bedritten. He might have eaten the girl with the red cap, too. In fact, that's rather likely. The poor thing wouldn't have been able to defend herself.

A possible LF-input for the interpretation of this text is something like the following:

(19) Must (if a wolf entered the house)(he have eaten grandma).
Might (if he entered the house)(he have eaten the girl with the red cap).
Likely (if he entered the house)(he have eaten the girl with the red cap).
Not have would (if he entered the house)(the poor thing ~~have~~ been able to defend herself).

The reconstructed LF has four *if*-clauses, but the source text only has one. It is obvious then that we cannot interpret *if*-clauses *in situ* and in a simple-minded framework. We have to store them until we find a modal or another appropriate operator that they can restrict, and

there can be more than one modal. Furthermore we have to allow for stacking of *if*-clauses. We will do that by introducing Kratzer's rule for modal modification. But even that will not do for all purposes: constructions with *if*-clauses exhibit properties of donkey sentences: the *if*-clause that comes first may introduce an indefinite that might be picked up anaphorically by a second *if*-clause:

(20) If a tourist is in Oslo, he must go to "Glasmagasinet", if he wants to buy a good sweater.

(21) ??If a he is in Oslo, he must go to "Glasmagasinet", if a tourist wants to buy a good sweater.

Another word that should not be ignored in the discussion of these and similar constructions is the role of *then*. *then* is optional or covert, and each modal or operator that can be modified by an *if*-clause can be accompanied by exactly one *then*. *then* may be thought of as an anaphor whose antecedent is an *if*-clause. So a more adequate LF for the text in (18) would be a representation like the following one:

(22) If$_i$ a wolf entered the house
Must (then$_i$)(he have eaten grandma).
Might (then$_i$)(he have eaten the girl with the red cap).
Likely (then$_i$)(he have eaten the girl with the red cap).
Not have would (then$_i$)(the poor thing ~~have~~ been able to defend herself).

The role of *if* might then be of carrying an anaphoric index for the *then* at the modal. It is obvious that we cannot interpret a text like this in a one-dimensional framework, be it static or even dynamic. We need an extra store for the *if*-clauses from which they can be taken if needed for a modal or other quantifier. (Schulz, 2009b) proposes such an extra store for "hypothetical contexts". So an approach along these lines seems the right thing to do. Recall that (Lewis, 1975) and Kratzer claim that *if* doesn't mean anything, rather *if*-clauses simply restrict quantifiers (or modals). Schulz disputes this. Well, *if* might be an anaphoric device and i*f*-clauses have a special status with respect to storage/semantic composition. If this is the meaning of *if*, we have to agree. But Schulz has given no argument against the claim that *if*-clauses simply restrict a quantifying element. For us, this is the important part of the Lewis-Kratzer claim.

For our purposes, the following account will do. The *if*-clause is combined with the modal via a special rule, which is similar to the rule that combines a relative clause with its

head noun, i.e. *Predicate Modification*. We call this rule *Modal Modification*:

(23) *Modal Modification (MM)*

Let α be a modal, R and accessibility relation, and let β be an *if*-clause (type it).

$[\![\alpha_R \beta]\!]^g = [\![\alpha_R]\!]^{g^*}$, where g* is like g with the exception that $g^*(R) = \lambda w \lambda t \{w' : w\ g(R)_t\ w' \ \&\ [\![\beta]\!]^g(w')(t)\}$

This is a tensed version of Modal Restriction given in (Kratzer, 1981) or (Kratzer, 2010). Note that the semantics of modals is tensed, i.e. which worlds are accessible depends on the local evaluation time. In other words, the accessibility relation R gives us different facts at different times because we know different facts at different times. The rule *Modal Modification* has an inbuilt temporal control device: one or several *if*-clauses that restrict the modal and the prejacent, i.e. the sentence to which the modal applies, are evaluated at the local evaluation time of the modal.

We will reconstruct one or several *if*-clauses to a position adjacent to and c-commanded by the modal. Thus the *if*-clause is subordinated to the modal at LF and we basically have regained the structural configuration from which we started in section 1. For the time being we ignore problems arising with indefinites in donkey configurations. For our purposes it suffices that the semantics of the modal and the rule *MM* forces us to have bound tense in the *if*-clause. Otherwise we would have a type mismatch. If one *if*-clause modifies several modals, we simply copy it to the adjunct positions of the modals that are to be modified.

3.1. Digression: Methods of Unification

We have assumed different modals for indicative and subjunctive conditionals. This simplifies the account for indicative conditionals, because the semantics for counterfactual *would* is complicated. We could unify the account. Recall that Stalnaker (cf. (Stalnaker, 1968); (Stalnaker, 1976)) and Lewis hold the view that indicative and subjunctive conditionals are analysed by means of the same operator, say Lewis' counterfactual operator $\Box\!\!\rightarrow$, a two-place version of our *would*. Indicative and subjunctive conditionals have the same truth-conditions but different appropriateness conditions. We use an indicative, if the antecedent is compatible with the local common ground, and we use the subjunctive, if it is not clear that the antecedent is compatible with the common ground. The common ground consists of the accepted "facts". These are compatible propositions and may therefore be

considered as single proposition, i.e. the intersection of the propositions in the common ground. (Note that Stalnaker himself never modelled the common ground as a set of propositions but rather as a set of worlds. The complication in Kratzer's semantics is due to her special way of defining counterfactual modals, i.e., the definition of the ordering relation.) If we use an epistemic modal in the style of Kratzer for the formalization of indicative conditionals, the common ground is taken as the modal base, i.e., the accessible worlds must be compatible with the common ground. Kratzer calls the modal base a conversational background for this reason. If we use Lewis' *would* for the formalization, the common ground must be added to the antecedent as a further premise. Since it is compatible with the antecedent, this account yields the same result as the formalisation with an epistemic modal. In the case of subjunctive conditionals, we have to use Lewis' modal and ignore the common ground for the evaluation. A somewhat more general unification is the version given in (Kratzer, 1981), where a modal is evaluated with respect to a modal base f and an ordering source g. Our epistemic modal MUST would then be a modal with a non-empty modal base and an empty ordering source. This is precisely what Kratzer says in (Kratzer, 2010). *would* would be a "must" with an empty modal base and a totally realistic background, say a set of Lewis' spheres. We have to add that in a tensed approach to modals, the common ground cannot be simply a set of worlds, it has to be a temporal property, i.e. a set world-times. For our purposes, a unification is not important. The different formalisation of indicative and subjunctive conditionals is practical for the reason that syntactically, the constructions behave rather differently.

4. BARE CONDITIONALS

We will now analyse some bare conditionals in detail. The following example has both the antecedent and the consequent in the present. The straightforward analysis is the following one:

(24) If Mary is in Oslo, John is happy.

N λt_1 [$\text{MUST}_R(t_1)$ **if** λt_2 **is**(t_2) λt_3 **Mary in**(t_3) **Oslo**] λt_4 **is**(t_4) λt_5 **John happy**(t_5)

$= \lambda w(\forall w')[w\ R_{s^*}\ w'$ & Mary is in Oslo in w' at s* → John is happy in w' at s*]

The copula expresses identity and is analysed as a raising verb. Here are the relevant meaning rules.

(25) a. $[\![\ \textbf{is}\ ]\!] = \lambda w \lambda t \lambda P_{it}.P(t)$.

b. [[**happy**]] = λwλtλx.x is happy in w at t.

c. [[**in**]] = λwλtλxλy.y is in x in w at t.

Look at the composition of MUST with the *if*-clause. $MUST_R$ means

$\lambda w \lambda t \lambda p_{s(it)} .(\forall w')\ wR_t w' \rightarrow p(w')(t)$.

You may compute for yourself that the *if*-clause means

λwλt.Mary is in Oslo in w at t.

The rule MM puts the two together and gives us:

$\lambda w \lambda t \lambda p_{s(it)}.(\forall w')(wR_t w'$ & Mary is in Oslo in w' at t → p(w')(t))

This result is obtained by changing the assignment. Our notation is sloppy in treating R as if it were a constant. It should be clear that we obtain the wanted result if we evaluate the rest. Note that ultimately the semantic present, i.e. the speech time s*, will be at the places where the bound tense variables are. This happens via λ-conversion. So both the antecedent and consequent are interpreted as if they contained a deictic present.

The following is a plain past conditional:

(26) If Peter bought this computer, he made a mistake.

N λt $MUST_R$(t) (if λt PAST(t) Peter bought(t)…)(λt PAST(t) he made(t)…)

Epistemic modals tend to be evaluated at the speech time or are perhaps always evaluated there. So this seems to be the most plausible analysis.[2] Note that due to λ-conversion, the semantic present N will be the local evaluation time both for the antecedent and the consequent. This will make the two tenses deictic.

It should be clear now that the examples given in the first section can be treated along the same lines.

The following example, which is due to Katrin Schulz, is a mixed case: the antecedent is in the past, the consequent is in the future:

(27) If Peter found the letter, he will kill the postman.

[2] In narrative contexts, epistemic modals are in the scope of PAST, but this PAST reflects the epistemic perspective of the narrator and thus behaves like a semantic present N in episodic contexts. Under attitudes it is the epistemic perspective of the attitude holder that counts. The attitude may be under PAST, but there MUST is never in the direct scope of a PAST in the complement.

An analysis compatible with our framework is this:

(28) N $MUST_R$ (if PAST Peter found…)(will he kill…)
$= \lambda w.(\forall w')[(wR_{s*}w' \ \& \ (\exists t < s^*)[P.\ found\ldots(t,w')]) \rightarrow (\exists t' > s^*)\ he\ kill\ldots(w',t')]$

Recall that we can always insert a covert FUT under a modal at LF if the meaning requires that; cf. (von Stechow, 2005). The auxiliary *will* and the covert operator FUT mean the same:

(29) $[\![\ FUT/\mathbf{will}\ ]\!] = \lambda w \lambda t \lambda P_{it.}\ (\exists t' > t)\ P(t')$

The following example has been discussed quite often in tense semantics. The problem is to explain why we can have a present in the antecedent. The answer is that a covert relative FUT can always be inserted under a modal, if the meaning requires so.

(30) If the weather is good tomorrow, we will go out.
N $MUST_R$ (if FUT is the weather good) (will we go out)

Note that bare conditionals are presumably never out-scoped by PAST:

(31) Yesterday, Franzis went to the dentist, if she still had those tooth pains.

This cannot mean that according to the evidence we had yesterday, Franzis went to the dentist, if she had those tooth pains. We evaluate epistemic modals at the actual time. So they must be in the semantic present.

4.1.Digression: "will" as a modal?

It has often been claimed in the literature that future *will* should be a modal (e.g. in the works of Abusch and Condoravdi). We have treated *will* as a time shifter according to the idea that there is only one real future and *will* speaks about that future. Suppose that I play chess with Mr. Bilter. My position is very good and I say:

(32) I will beat him.

If some moves later, i.e. at some time later, I blunder my queen and Mr. Bilter wins, then I have made a false statement. If this argument is valid, our simple account of *will* is correct.

For the sake of the argument, suppose we want to regard *will* as a modal after all. What kind of modal could it be? It certainly cannot be a possibility modal meaning something like "there is a possible future in which the antecedent and the consequent are true". That would make the analysis of mixed conditionals like that in (27) impossible because the evaluation time of the antecedent would be switched to the future and, contrary to the facts,

the PAST in the antecedent would be evaluated relative to that future time. Furthermore, the statement would be much too weak, because we don't speak about just *one* possible future but of all likely ones. Let us try then to bring *will* closely together with the modal *would*:

(33) *will* as modal?

$[\![\textbf{will}_R]\!]^{g \leq} = \lambda w \lambda t \lambda p_{sit}$: g(R) as below.$(\forall w')[(w\ g(R)_t\ w' \ \&\ \neg(\exists w'')[w\ g(R)_t\ w'' \ \&\ w'' <_w w']) \rightarrow (\exists t' > t)\ p(w')(t')]$,

where $w\ g(R)_t\ w'$ iff w and w' have the same past up to time t.

The analysis of (27) would now the following:

(34) N λt $will_R$ (t) (if λt PAST(t) P. found…)(λt he kill…)

$\lambda w.(\forall w')[(w\ g(R)_{s*}\ w' \ \&\ (\exists t_1 < s^*)$ P. finds L. $(w', t_1) \ \&\ \neg(\exists w'')[w\ g(R)_{s*}\ w'' \ \&\ w'' <_w w' \ \&\ (\exists t_2 < s^*)$ P. finds L.$(w'', t_2)]) \rightarrow (\exists t_3 > s^*)\ p(w')(t_3)]$

The temporal location of the *if*-clause is exactly as in our previous analysis (28): both the past and the future are evaluated with respect to the speech time s*. This is due to the circumstance that the worlds the modal quantifies over have a common past and the *now* is the same as well. The new thing is the modalization. Apart from the problem that the quantification over most likely futures might make the truth-conditions too weak, we have to face several problems. The first is negation. The sentence

(35) It will not rain tomorrow

doesn't mean "there is at least one very likely future at which it doesn't rain". It rather means "there is not a likely future at which it rains". So we have to stipulate that the negation can never have wide scope with respect to "will". Another problem is that the sentence (27) is trivially true, if Peter didn't find the letter. This is so because a past antecedent is evaluated in the real world. So the statement behaves like a material conditional in this case. We could perhaps overcome this problem by inserting a covert epistemic modal between N and "will" in (27). So the LF would rather be the following one:

(36) N $MUST_R$ λt $will_R$ (t) (if λt PAST(t) P. found…)(λt he kill…)

This makes the meaning certainly weaker than before and quite opaque. Does the modal analysis make any nice predictions? We are not aware of any. For example, it would be a merit if the modal analysis could get rid of the covert future we assumed for the LF for (30):

(37) If the weather is good tomorrow, we will go out.

But we need a FUT in the antecedent also in the modal analysis. The reason is that the antecedent is evaluated with respect to the speech time, but we have to evaluate it at some future time.

For the time being we conclude that we haven't found good arguments for a modal analysis. On the contrary, it still raises a number of open questions. So we will not follow this path but stick to the analysis of "will" as a simple time shifter.

5. LICENSING THE MORPHOLOGY

We introduce our feature system that licenses the temporal morphology. In a way this system is essential for the syntax-semantics-morphology interface. The system is inspired by the notion of global agreement of features in (Zeijlstra, 2004), but our conventions are rather different. In particular, the idea of feature transmission under binding is due to (Heim, 1994) and (Kratzer, 1998).

1. We have 3 kinds of features: interpretable features iF, uninterpretable features uF, where the latter are split into syntactic u-features (written as uF *simpliciter*) and morphological or inherent uninterpretable features (written as mF).

2. Each iF-feature originates with a semantic operator and is transmitted under binding as an uF to a variable bound by the operator.

3. Most stems of finite verbs have a morphological/inherent feature mF. mF must be licensed by a corresponding feature uF at the time or event variable of the verb ("checking by agreement"). Non-finite verbs, adjectives or prepositions don't have morphological temporal features.

4. Verbs, adjectives and operators in general transmit inherited features to the variables they bind provided there is no competition with an i-feature carried by the former.

We use the following features:

(38) Time and mood features

a. [i-n] "now", originates with the semantic present N.

b. [i-p] originates with the semantic past PAST.

c. [i-perf] originates with the temporal auxiliary *have*.

d. [i-sub] originates with *would* and verbs of attitude in German and many other languages.

There are some complications arising with the feature [sub] "subjunctive", which we will discuss in the following section. Let us consider indicative sentences first.

(39) John stayed home

N λ_1 PAST(t_1) λ_2 **John stayed**(t_2) **home**

i-n i-p u-n m-p u-p

The feature i-n is transmitted to the local evaluation time t_1 of PAST. PAST(t_1) binds the variable t_2, but i-n is not transmitted because it is in conflict with the feature i-p of PAST. i-p is transmitted under binding to t_2. There, u-p agrees with the inherent feature m-p of the finite verb *stayed*. Keep in mind that *stayed* has no interpretable past-feature. The verb is interpreted exactly as a non-finite form of the verb:

(40) *stayed* type s(it)

[[**stayed**]] = [[**stay**]] = λwλtλx.x stays in w at t.

Quite generally it holds that all morphological forms of verbs are interpreted alike, namely tense-less. If aspect is integrated into the system, many verbs will be properties of events, but this is not our concern here.

Let us take up example (8):

(41) If John went out smiling, the interview went well.

N λt MUST(t) (if λt PAST(t) …**went**(t)…)(λt.PAST(t) λt…**went**(t)…)

i-n u-n i-p u-n m-p u-p i-p u-n m-p u-p

The covert epistemic modal MUST has no inherent temporal feature. The matrix present N guarantees that it is evaluated with respect to the speech time s*. We have to stipulate that MUST(t) binds the temporal variable of all the λ-abstracts in its scope. This is obvious for the prejacent and reasonable for the *if*-clauses as well because the rule *MM* has temporal control inbuilt in its semantics. Temporal control makes sure that both embedded PASTs are evaluated with respect to s*, i.e., they are deictic.

Our approach has to face the following problem. How can we prevent epistemic MUST from being embedded under PAST? Then the embedded PASTs and the known facts would be evaluated with respect to a past time. Such a reading doesn't exist for (8)/(41). To block it, we stipulate the following:

(42) *Feature checking*

Each feature [i-past] must be checked by at least one feature [m-past], where the checking affects a transmitted feature [u-past]

This rules out the following LF:

(43) N λt PAST(t) λt MUST(t) (if λt PAST(t) …**went**(t)…)(λt.PAST(t)λt…**went**(t)…)
i-p u-p i-p u-p
u-p!

The feature i-p originating with the matrix PAST is transmitted to the embedded PASTs via binding, but there the transmission is blocked because the embedded PASTs have the feature i-p, and this competes with the transmitted u-p and wins the competition. But this means that the feature i-p originating with the matrix PAST is not checked by a morphological past-feature, a violation of our principles of feature checking. So this LF is ruled out.

Let us look at the mixed case in (27) next:

(44) If Peter found the letter, he will kill the postman.
N $MUST_R$ (if PAST Peter found…)(will he kill…)
i-n u-n i-p u-p m-n
u-n

We have only indicated the relevant features. The important point is that *will* has the feature m-n, which is checked by the feature coming from matrix present.

6. Embedded Bare Conditionals

If we embed bare conditionals under verbs of attitude, we expect that the SOT rules apply. The main tense of the embedded clause has to be zero tense then. Let us see what we predict for an embedding of (27) under believing:

(45) Mary believes that Peter will kill the postman, if he found the letter.

The LF for the embedded indicative conditional is:

(46) ~~TPRO~~$_1$ $MUST_R$ (t_1) (if λ_2 PAST(t_2) λ_3 Peter found(t_3)…)(λ_4 will(t_4) λ_5 he kill(t_5)…)
u-n u-n i-p u-n m-p u-p m-n u-n

Recall that the rules of construal (cf. e.g. (Grønn and von Stechow, 2010a, von Stechow, 2009) assume that we have a semantically empty pronoun TPRO (or TPRO) at the time position. This PRO has to be moved for type reasons and creates a λ-operator that binds the original argument position. This kind of theory is inspired by the account or relative pronouns in (Heim and Kratzer, 1998), by (Kratzer, 1998) and by personal remarks of Irene Heim. PRO-movement will create a binding chain. For instance, the if-clause in (45) has the following derivation:

(47) Spell-Out: if [$_{TP}$ PAST(PRO) [$_{VP}$ Peter found(PRO) the letter]]
=> PRO-movement and deletion of un-interpretable material
~~if~~ [$_{TP}$ ~~PRO~~$_1$ PAST(t_1) ~~PRO~~$_2$ [$_{VP}$ Peter found(t_2) the letter]]
= $\lambda w \lambda_1 (\exists t_2 < t_1)$ Peter finds the letter in w at t_2

Recall that the movement index is the λ-operator. The highest PRO, which occupies the place where we normally find the semantic present N, is what is called a zero tense. Following the conventions for semantic binding in (Heim and Kratzer, 1998) we assume that there is a binding chain from λ_1 to t_2 , though λ_1 doesn't bind t_2 directly, of course. For convenience, we give the lexical entry for *believes/believed*:

(48) *believe* type i(s(it),(et))
believes [m-n] [i-sub]
believed [m-p] [i-sub]
[[believes/believed]] = $\lambda w \lambda t \lambda p_{s(it)} \lambda y.(\forall w',t')[(w,t)\ Dox_y\ (w',t') \rightarrow p(w')(t')]$

We will see in a moment why *believe* induces a feature [i-sub]. Let us look at the relevant features in (45) again:

(49) N Mary believes MUST (if PAST he found the letter)(Peter will kill the postman)
i-n u-n u-n u-n u-n

The covert modal MUST inherits the feature [u-n] from the matrix present N via *believes*. Since MUST binds both the tense in the *if*-clause and the temporal variable of *will*, both temporal operators are evaluated with respect to the same time, i.e., we get temporal control with respect to the "subjective now". If the two clauses were not united by MUST, such an account would be impossible. The feature sub does no job here and is therefore neglected.

Next, let us embed (27) under *believed*. Then the SOT-rules tell us that we obtain the following two variants:

(50) Mary believed that Peter would kill the postman, if he found the letter.
N PAST…believed PRO ……..would kill…, if PRO PAST he found…
i-p u-p u-p u-p u-p i-p u-p
i-sub u-sub u-sub

Here the backward shifting in the *if*-clause is done by a local PAST. If we leave this PAST away, we obtain a simultaneous interpretation. In this construction the feature [sub] is needed because it licenses the morphology of the future auxiliary *would*. The auxiliary

cannot occur in a matrix clause. It must be in the scope of an attitude or counterfactual *would*. Therefore *would* must have the inherent features m-p and m-sub.

In the second variant the backward shifting in the *if*-clause is achieved by the perfect auxiliary *had*. To avoid double backward shifting, we cannot have a local PAST in the *if*-clause but only zero tense.

(51) Mary believed that Peter would kill the postman, if he had found the letter.

N PAST …believed PRO would kill the postman, if PRO had he found…

i-p u-p u-p u-p u-p u-p u-p
i-sub u-sub u-sub

The complement sentences above surface exactly as if they were counterfactual *would*-conditionals. But the constructions are very different. The intended reading in our case is the one where Mary's belief is worded as: "If Peter found the letter, he will kill the postman". This is not a counterfactual conditional. In German, the intended reading can be spelt out by means of the subjunctive present (and the subjunctive past)

(52) Marie glaubte, Peter werde (sub.pres) den Briefträger töten, falls er den Brief gefunden habe (sub.pres).

Here, the embedded conditional cannot be interpreted as a counterfactual. Alternatively, one can simply embed an indicative present, which does the same disambiguating job.

(53) Marie glaubte, Peter wird (ind.pres) den Briefträger töten, falls er den Brief gefunden hat (ind.pres).

Or we can have the indicative past in the *if*-clause:

(54) Marie glaubte, Peter wird (ind.pres) den Briefträger töten, falls er den Brief fand (ind.past).

If we use the subjunctive past, we get the same ambiguity as in English:

(55) Marie glaubte, Peter würde (sub.past) den Briefträger töten, falls er den Brief gefunden hätte (sub.past).

This discussion tells us something interesting about the morphological subjunctive features in German and English.[3] In English, the subjunctive is neutralized in most case. Therefore

[3] The distribution has been described for the first time in von Stechow, Arnim, and Grønn, Atle. 2009. The (Non-)Interpretation of Subordinate Tense. In *Talk presented at the University of Göttingen*.

we state the richer rules for German and indicate in which case the two languages behave alike with √. English * means that the corresponding combination doesn't exist in English or is ungrammatical.

(56) Indicative/Subjunctive in German

1. *Verba dicendi et sentiendi* and the counterfactual modal *würde* ('would') have the feature [i-sub] but are neutralised with respect to temporal features. (English √)
2. Verbs in the indicative present are neutralised with respect to temporal and modal features. (English *)
3. Verbs in the indicative past are neutralised with respect to modal features but have the feature [m-p]. (English *)
4. Verbs in the subjunctive present have the feature [sub], but are neutralised with respect to temporal features. (English *)
5. Verbs in the subjunctive past are marked with respect to both features. (English √)

We have marked the points where English is like German with √.

(4) explains why (52) is good: *werde* is a semantic future with the feature [m-sub] but without an inherent temporal feature.

(2) explains why (53) is good. The indicative present *wird* expresses a semantic future but has neither an inherent tense feature nor an inherent mood feature. Hence, there is no conflict with the inherited features [u-sub] and [u-p].

(5) concerns the streamlined case (55): both future *würde* and the perfect *hätte* have the inherent features [m-sub] and [m-p]. And these are licensed by the inherited features [u-sub] and [u-p].

The English example (50) is similar to the German in (53), but there are differences. Look at it again:

(57) Mary believed that Peter would kill the postman, if he found the letter. [=(50)]
N PAST…believed PRO…would kill…,if PRO PAST he found

(51) is similar to the German one in (55), but there is a difference. Future *would* has the features [m-p] and [m-sub], but *had* only has the feature [m-p] and is neutralised with respect to [sub].

7. Features in Subjunctive Conditionals

Subjunctive conditionals are not the topic of this paper. We treat these constructions extensively in Grønn & von Stechow 000. Here we say something about the feature

distribution in subjunctive conditionals for reasons of comparison. We start with *would*-conditionals.

(58) If John were sick, he would stay home.

N λ_1 would$_R$ (t_1) (if λ_2 John were(t_2) sick)(λ_3 he stay(t_3) home)

i-n i-p, i-sub m-sub,m-p

u-n

were is one of the few still existing subjunctive forms in English. The subjunctive modal *would* has no inherent mood or tense feature, but it licenses the subjunctive past and therefore has the features i-p and i-sub. We can have *was* instead of *were*. We say then that *was* has the feature [m-p] but is neutralized with respect to mood. The feature i-p originating with an operator that is not a semantic past encodes the fact that we observe *tense transposition* in subjunctive conditionals, i.e. statements that look like past statements are semantically present. Similarly we expect that subjunctive conditionals that look as if they were pluperfect statements are past statements. This is what we find in *would-have*-conditionals.

(59) If John had been sick, he would have stayed home.

N λ_1 have(t_1) λ_2 would$_R$ (t_2)(if λ_3 had(t_3) λ_4 been(t_4) John sick)(λ_5 he stayed(t_5))

i-n i-perf i-p,i-sub m-p

u-n u-perf

u-p

u-sub

We have given ample motivation in other papers that *have* must out-scope the counterfactual modal *would* in this kind of construction. *have* status-governs a perfect participle, which is encoded by the feature [i-perf]. The problem with this construction is that the *had* in the *if*-clause must be semantically void in this construction, because the matrix *have* shifts the entire construction into the past and the *if*-clause is not necessarily temporally back shifted with respect to the main clause. In some sense *had* is an agreement phenomenon with the shifting of *would* toward the past. For the time being we say this:

(60) Semantically void *had*

had with inherited features [u-p] and [u-perf] can be interpreted as identity, i.e. as $\lambda w \lambda t \lambda P_{it}.P(t)$.

Note that the feature combination [u-sub] and [u-p] would not do for *have*-deletion, because we have perfect auxiliaries with these features that are interpreted as a relative past:

(61) Maria glaubte, sie hätte Franz gesehen

Here, *hätte* inherits the features u-p and u-sub from *glaubte*. *hätte* has these features as inherent features and is therefore licensed here. Furthermore, it is interpreted as a relative past. The corresponding English sentence has to be analysed (almost) in the same way.

(62) Mary believed that she had seen Franz.

had only has the feature [u-p], so it would be enough to stipulate only the feature [m-p] for *believed*. But then we could not license a future *would* under a verbum dicendi: we cannot say that future *would* only has the feature [m-p], because then *would* would be licensed in matrix sentences under PAST, contrary to the facts. So we say that future *would* has the features m-p and m-sub and *believed* has the features m-p and i-sub. A prediction of this account is that the following sentence is grammatical:

(63) Mary believed John were sick.

Presumably no one says this. We are not too worried because the construction is so marginal that the predictions of our theory are not so important in this respect.

Perhaps the prediction made in (60) is too weak and too strong. The principle says that the auxiliary *had* in the *if*-clause can occasionally be interpreted. The following example might provide such a case:

(64) If John already had bought his car then, he would have invited Mary for a drive.

Here we seem to have a local perfect in the antecedent. On the other hand, the principle predicts that we can ignore *hätte* under *hat geglaubt*:

(65) Marie hat geglaubt, dass sie Franz gesehen hätte.
=? Marie hat geglaubt, dass sie Franz sähe

We haven't checked this prediction, but presumably it is wrong. I that case, our last resort would be a construction specific deletion rule for *had* in *if*-clauses of *would-have*-conditionals.

Let us finally consider the case of embedded subjunctive conditionals:

(66) Mary believes John would stay home, if he were sick.

N believes PRO would (if PRO were …sick)(stay home…)

i-n u-n u-n u-n

i-p,i-sub u-sub,u-p

The picture should convince you that everything is fine.

We have problem if the attitude verb is in past tense:

(67) N PAST Mary believed John would stay home, if he were sick.

i-n i-p u-p,i-sub u-p u-p,u-sub

i-p,i-sub

Not much has changed. *would* inherits a past-feature from *believe*, but it induces its own past and subjunctive features. These are checked by the embedded *were*. The point is that we can insert the same "present"-counterfactual both under "believes" and under "believed". If *would* had the inherent feature m-n, we could not have it under *believed*, because we cannot have Present und Past in attitudes, if we disregard the special double access reading.

Finally let us say how our theory copes with a contrast observed in (Abusch, 1993):

(68) *When John was a schoolboy, he ought to study harder.

(69) ^{OK}When John was a schoolboy, he ought to have studied harder.

(70) John thought that he ought to study harder.

ought has the same features as *would*:

(71) Features of *ought*

no m-features, but [i-p] and [i-sub].

The construction (68) is ruled out by our principle Feature Checking in (42). A simplified LF for (68) is:

(72) N PAST ought John to study harder.

i-p i-p,i-sub

u-p

ought has no feature [m-p]. Therefore the feature [i-p] of PAST is not checked and the sentence is out. Note again that modals traditionally classified as subjunctive past have the features [i-p, i-sub] though they are not semantic past. This explains their exceptional

behaviour with respect to temporal interpretation: the modals are fake past but they license an un-interpreted past. It is the modal that brings us into remote worlds, not the past tense. If it were the past tense that would bring us into remote worlds, we could not distinguish between modals like *would*, *ought*, *could*, *might*, they are tense-less but quantify over remote worlds, and they do that in a different way.

Back to the examples: (69) is analysed in analogy to a *would-have*-conditional. (70) raises no problem, because the matrix PAST is made visible by *believed* and the embedded past verb is licensed via feature transmission.

These remarks conclude our account of the temporal organisation of indicative conditionals.

8. Appendix 1: Feature Survey

Our features are [n] "now", [p] "past", [perf] "perfect" and [sub]. They are prefixed by i- (interpretable), u- (uninterpretable and transmitted) or m- (uninterpretable and inherent/morphological).

Here are some relevant lexical entries for English.

(73) Tenses

a. Present: N i-n

b. PAST: i-p

c. Covert FUT: no features

(74) Modals

a. Covert MUST: no features

b. Overt *must/can*: m-n

c. Counterfactual *would/could*: i-p, i-sub

(75) Temporal auxiliaries

a. Relative past:

have: i-perf

has: m-n, i-perf (specialized for extended now perfect)

had: m-p, i-perf

b. Relative future:

will: m-n

would: m-p, m-sub

(76) Copulas

a. *be*: no features

b. *been*: m-perf

c. *is*: m-n

d. *was/were*: m-p

e. *were*: m-p, m-sub

(77) a. *eat*: no features

b. *ate*: m-p

c. *eaten*: m-perf

And here are the entries for German:

(78) Tenses: like in English

We ignore differences of uses. German is much more liberal with the use of covert FUT. In English, we can insert FUT only in the scope of a modal. In German we can have it under a semantic present if the VP is telic.

(79) Modals

a. Covert MUST: like in English

b. Overt modals:

(1) *muss/kann*: m-n

(2) *musste/konnte*: m-p

(3) *müsse/könne*: m-sub

(4) *müsste/könnte*: m-sub, m-p

c. Counterfactual modals: like in English

würde/könnte: i-p, i-sub

Remember the additional principle we have assumed for the checking of i-past:

(80) Feature checking

Each feature [i-past] must be checked by at least one feature [m-past], where the checking affects a transmitted feature [u-past].

We finally remark that we find no reason to assume a feature [indicative] as Schlenker has it in a number of papers (cf. e.g. (Schlenker, 2003)).

9. Appendix 2: Semantics

We give the recursive interpretation of the formal language we are using for the analysis.

Our language is an intensional λ-language of the kind used in (Heim and Kratzer,

1998), chapter 13. "Intensional" means that expressions of type a express meanings of type (sa), i.e., a-intensions. The types used are e (individuals), i (time intervals), t (truth-values) and s (worlds). Syntax and the semantic domains are as usual. F is a function that assigns each lexical entry of type a a corresponding intension, i.e. a function of type sa. A model $\mathfrak{M}$ consist of (E,W,T,…,F), where E are the individuals, W are the worlds, T the times, F the lexical function. Furthermore we need appropriate structures for T and W.

(81) Recursive definition of the interpretation function $[\![.]\!]_{F,g}$

1. Let α be a lexical entry of type a. Then $[\![\alpha]\!]^{\mathfrak{M},g} = F(\alpha)$.
2. Let x be a variable of type a. Then $[\![x]\!]^{\mathfrak{M},g} = \lambda w.g(x)$, g(x) in D_a.
3. Functional Application.: Let α have type b and daughters β of type ab and γ of type a. $[\![\alpha]\!]^{\mathfrak{M},g} = \lambda w.[\![\beta]\!]^{\mathfrak{M},g}(w)([\![\gamma]\!]^{\mathfrak{M},g}(w))$
4. Intensional Functional Application: Let α have type b and daughters β of type (sa)b and γ of type a.
   $[\![\alpha]\!]^{\mathfrak{M},g} = \lambda w.[\![\beta]\!]^{\mathfrak{M},g}(w)([\![\gamma]\!]^{\mathfrak{M},g})$
5. Predicate Modification: Let α have type a and daughters β and γ of the same type.
   $[\![\alpha]\!]^{\mathfrak{M},g} = \lambda w.\lambda x.[\![\beta]\!]^{\mathfrak{M},g}(w)(x) \,\&\, [\![\gamma]\!]^{\mathfrak{M},g}(w)(x)$
6. Modal Modification: Let α be a modal, R an accessibility relation, and let β be an if-clause (type it).
   $[\![\alpha_R\ \beta]\!]^g = [\![\alpha_R]\!]^{g^*}$, where g* is like g with the exception that $g^*(R) = \lambda w\lambda t\{w' : w\ g(R)_t\ w' \,\&\, [\![\beta]\!]^g(w')(t)\}$
6. Abstraction: Let x be a variable of type a and let α be an expression of type b.
   $[\![\lambda x\ \alpha]\!]^{\mathfrak{M},g} = \lambda w.\lambda u \in D_a.[\![\alpha]\!]^{\mathfrak{M},g[x/u]}(w)$

In our examples, the rule Intensional functional application has to be applied, when it comes to the evaluation of modals or attitudes.

REFERENCES

Abusch, Dorit. 1993. Two Theories of Tense in Intensional Contexts. Paper presented at *Proceedings of the 9th Amsterdam Colloquium*.

Dowty, David. 1979. *Word Meaning and Montague Grammar: the semantics of verbs and times in generative semantics and in Montague's PTQ*: Synthese Language Library. Dordrecht: Reidel.

Grønn, Atle, and von Stechow, Arnim. 2010a. Complement Tense in Contrast: The SOT parameter in Russian and English. In *Russian in Contrast. Grammar*, eds. A. Grønn and I. Marianijanovich, 109 - 154. Oslo: Universitetet i Oslo.

Grønn, Atle, and von Stechow, Arnim. 2010b. Future vs. Present in Russian and English

Adjunct Clauses. Ms., *Talk presented in St. Petersburg on May 21 2010*.
Heim, Irene. 1994. Puzzling reflexive pronouns in de se reports: Handout from Bielefeld conference.
Heim, Irene. 1997. Tense in compositional semantics: MIT lecture notes.
Heim, Irene, and Kratzer, Angelika. 1998. *Semantics in Generative Grammar*: Blackwell Textbooks in Linguistics. Oxford/Malden, MA: Blackwell.
Ippolito, Michela. 2003. Presuppositions and Implicatures in Counterfactuals. *Natural Language Semantics* 11:145-186.
Kratzer, A. 1978. *Semantik der Rede. Kontexttheorie - Modalwörter - Konditionalsätze*. Kronberg/Ts.: Scriptor.
Kratzer, A. 1979. Conditional Necessity and Possibility. In *Semantics from Different Points of View*, eds. A. von Stechow and et al., 117-147. Berlin: Springer.
Kratzer, Angelika. 1977. What 'must' and 'can' must and can mean. *Linguistics and Philosophy* 1:337-355.
Kratzer, Angelika. 1981. The notional category of modality. In *Words, Worlds, and Contexts*, eds. H. J. Eikmeyer and H. Rieser, 38-74. Berlin: de Gruyter.
Kratzer, Angelika. 1998. More Structural Analogies Between Pronouns and Tenses. In *SALT VIII*, eds. D. Strolovitch and A. Lawson. Cambridge, Mass.: Ithaca: CLC-Publications.
Kratzer, Angelika. 2010. Conditionals. In *Collected Papers on Modals and Conditionals*: Oxford University Press (to be published).
Lewis, David. 1973. *Counterfactuals*. Oxford: Basil Blackwell.
Lewis, David. 1975. Adverbs of Quantification. In *Formal Semantics of Natural Language*, ed. E. Keenan, 3-15. Cambridge: Cambridge University Press.
Lewis, David. 1979. Counterfactual Dependence and Time's Arrow. *Noûs* 13:455-476.
Schlenker, Philippe. 2003. A Plea for Monsters. *Linguistics & Philosophy* 26:29-120.
Schulz, Katrin. 2009a. Conditionals from Top to Bottom. In *SuB 14*. Vienna: Unpublished Powerpoint Presentation.
Schulz, Katrin. 2009b. Trouble at the Semantics/Syntax Interface: Some thoughts about the modal approach to conditionals. Paper presented at *Sinn und Bedeutung 14*, Vienna.
Stalnaker, Robert. 1968. A Theory of Conditionals. In *Studies in Logical Theory*, ed. Nicholas Rescher, 41-55. Oxford: Blackwell.
Stalnaker, Robert. 1976. Indicative Conditionals. In *Language in Focus*, ed. A. Kasher, 179-196. Dordrecht: Reidel.
von Stechow, Arnim. 2005. Semantisches und morphologisches Tempus: Zur temporalen Orientierung von Einstellungen und Modalen [August 2005]. *Neue Beiträge zur Germanistik* 4 (2):36.
von Stechow, Arnim. 2009. Tenses in Compositional Semantics. In *The Expression of Time*, eds. Wolfgang Klein and Ping Li, 129 - 168. Berlin
New York: Mouton de Gruyter.
von Stechow, Arnim, and Grønn, Atle. 2009. The (Non-)Interpretation of Subordinate Tense. In *Talk presented at the University of Göttingen*.
Zeijlstra, Hedde. 2004. *Sentential Negation and Negative Concord*. Utrecht: LOT.